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THE TREATMENT OF FRACTURES  
BY  
MOBILISATION AND MASSAGE



MACMILLAN AND CO., LIMITED

LONDON . BOMBAY . CALCUTTA  
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THE MACMILLAN COMPANY

NEW YORK . BOSTON . CHICAGO  
ATLANTA . SAN FRANCISCO

THE MACMILLAN CO. OF CANADA, LTD.

TORONTO





JUST LUCAS-CHAMPIONNIÈRE.

*Frontispiece.*

# THE TREATMENT OF FRACTURES BY MOBILISATION AND MASSAGE

BY

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INTERNATIONALE DE CHIRURGIE, ETC.

MACMILLAN AND CO., LIMITED  
ST. MARTIN'S STREET, LONDON

1911

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## PREFACE

I CANNOT claim to have originated the methods of treatment advocated in this book, inasmuch as they are founded very largely on those of Professor Just Lucas-Championnière, of Paris, from whose work, *Traitemenit des Fractures par le massage et la mobilisation*, and from other of his less known publications and papers, most of my quotations are made.

Free use has also been made of the *Massage des Membres* of Dr. Dagron, of Paris, himself “ancien interne des Hôpitaux” and a former pupil of Professor Lucas-Championnière.

I am glad to take this opportunity of thanking the Professor for his great courtesy and kindness to me during three visits to Paris made for the purpose of consulting with him, and for the valuable help and advice on which I have drawn so liberally in dealing with my present subject. Now he has added to his many

kindnesses that of reading my manuscript and writing the introduction which follows.

When reading the manuscript the Professor inserted some dozen slips bearing notes of various points which he wished to discuss with me before the publication of the book. In one instance only has it been necessary to alter the text, and that merely to make a trivial alteration in the history of one of his cases. I therefore feel that, while I am still able to call it my own, this book bears a kind of hall-mark from the Professor ; and I publish it with a lively sense of the responsibility which he has laid upon its pages in committing to them the task of laying before the medical men of this country an adequate exposition of the treatment which he inaugurated many years ago, and which he has laboured indefatigably ever since to render universal for the benefit of suffering humanity.

I am particularly glad and grateful to note that the Professor, in his Introduction, has been kind enough to acknowledge that this book is in no way a translation of, or even a compilation from, his various writings. As he has said, I began with the study of his principles, then put them into practice, and have now recorded in writing the result of reflection associated with

practical experience. Freely as I have quoted from the Professor's works much is altogether my own ; though, thanks to his kindness, I am able to claim his approval and sanction for the whole work.

The emphatic way in which the Professor speaks of the danger of submitting the treatment of fractures to those who are presented to us as the generally accepted exponents of massage is very note-worthy ; and I am indeed content to find how entirely in accordance with his views are those which I have expressed with regard to the operative treatment of fractures.

To Dr. Dagron I am greatly indebted for a visit to his clinic at the Hospital "Accidents du Travail," where I was able to witness his treatment and its results.

There is no history of the treatment of fractures by mobilisation and massage, nor any literature to study, except the books already mentioned and small works by Sir William Bennett and Dr. Wharton P. Hood ; though massage treatment for other conditions seems to have been recognised in times of the greatest antiquity, in China and India, and, later, at Athens and at Rome, where gladiators had recourse to massage before and after their

encounters. In more recent times, Ambroise Paré seems to have been the first to insist upon its merits, though apparently without much success.

I have, therefore, decided to compare this modern treatment with that usually employed in this country. Following this plan, a short reference has been made to the classical treatment, as set forth in the various text-books, in dealing with the treatment of each individual fracture. The *Manual of Surgical Treatment* by Cheyne and Burghard has been chosen as a book of reference; the *Manuals of Surgery* by Rose and Carless and by Thompson and Miles are quoted as representing the ordinary surgical teaching of the present day in the English and Scotch medical schools respectively; while, finally, this teaching is compared with that of Timothy Holmes, as published in his book on Surgery in 1875, in order to demonstrate how small has been the progress made in the surgical treatment of fractures during the last thirty-five years. The treatment and prognosis as found in Professor Lucas-Championnière's writings follows, supplemented by the results of the present writer's personal experience.

As this book deals essentially with treatment,

brief reference only has been made to theory. The pathology of the results obtained by massage has yet to be worked out: I know of one paper only on this subject, written by Dr. Castex and quoted in the "Archives générales de Médecine," 1891. Reference to this paper will be made in due course.

The pathology of the results of mobilisation in the treatment of injuries seems, indeed, to be limited to the axiom of Aristotle, "Movement is Life." Hence attention is given in the following pages to practical results rather than to pathology.

In justification of my claim to speak from experience of this method of the treatment of fractures, I may say that I have notes of all cases treated by me, after the first trial of some two months' duration, to the number of about four hundred. This considerable experience I owe primarily to the kindness of the authorities of St. Thomas's Hospital in affording me every opportunity of treating a large majority of the fractures not admitted to the wards. To the late Mr. H. H. Clutton, to Mr. C. A. Ballance, and to Mr. E. M. Corner, I owe a deep debt of gratitude for much kind assistance and encouragement. To Dr. Greg I owe much for his valuable teaching, help, and advice, on

which I have drawn freely. It is with his kind permission that I reproduce the X-ray photographs. Originally it was my intention to publish the X-ray photograph of every case referred to in the text. As ill-luck would have it, the annual clearance of all the old photographs in Hospital took place during the course of a recent illness of several months' duration. Those which I had hoped to reproduce vanished with the rest, and I am able to publish those only which I happened to have in my possession, viz., those which I had presented at Cambridge when I offered this book in its original form as a Thesis for the M.D. degree. I have therefore been compelled to be content, when referring to any individual case, to quote the official report (as entered by Dr. Greg) in the records of the X-ray Department.

When I commenced my work I had had no previous experience of massage, but this I hold to have been an advantage. The majority of my work has been single-handed, although I have had as many as sixty cases in various stages of treatment on my list in one week. For some two months, however, I received great assistance from a nurse in the treatment of some of my female patients. Both they and myself are in her debt. Like myself, this nurse had

had little or no experience of massage, but in the course of a few days I was able to give her sufficient instruction in my methods to render her assistance of the utmost value. Professor Lucas-Championnière observes that he has had occasion to call upon the services of an intelligent domestic servant to carry out his treatment, and that he was well pleased with the performance of his instructions. Thus it will be seen that no special experience is called for when the treatment of fractures on the lines advocated is to be undertaken.

I am very conscious that much has been omitted from this book which might well have found a place. I have adopted the kindly criticism of my fellow-officers at St. Thomas', which in its twelve months' course embraced, I fancy, every conceivable argument against my methods, and have used my answers thereto as a foundation on which to build.

The most auspicious feature of this method of treatment is its simplicity: gentleness of touch is all that is required, and thus there is no inherent obstacle in the way of its universal adoption. But, as Professor Lucas-Championnière has said in his Introduction, the treatment must not be left to the imagination of those who would practise. Certain fundamental principles

must not be put aside ; and it is the object of this work to set forth those principles, the value of which is so little realised in this country at the present time, and to offer, as far as may be possible, a scientific explanation of the facts on which they are founded.

My brother, G. G. Mennell, H.C.S., has revised and edited this book throughout its various stages—thesis, manuscript, and proof. Any literary merit it may be found to possess is largely due to his care.

J. B. M.

1, ROYAL CRESCENT,  
LONDON, W.

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# THE TREATMENT OF FRACTURES BY MOBILISATION AND MASSAGE

## INTRODUCTION

BY DR. JUST LUCAS-CHAMPIONNIÈRE

J'AI grand plaisir à présenter au Public médical Britannique l'ouvrage de Dr. James Mennell consacré à la diffusion d'une méthode dont je suis le père. Je suis surtout heureux d'avoir trouvé dans son livre un excellent essai personnel d'adaptation scientifique. Ce livre n'est pas simplement la traduction, le commentaire mot à mot de mes livres. Il est l'œuvre de l'homme qui s'est inspiré de principes, qui a fait une expérience complète d'une méthode et qui expose ce qu'il a observé lui-même dans l'application de cette méthode.

Lors d'un voyage à Londres j'avais vu avec grand intérêt à l'hôpital St. Thomas<sup>1</sup> l'organisation parfaite d'une consultation pour fractures traitées par le mouvement, organisation telle que

<sup>1</sup> I slowly developed this "organisation" while Casualty Assistant: it ceased for good on my appointment as House Surgeon.—J. B. M.

## 2 TREATMENT OF FRACTURES

je souhaiterais que l'on en trouvât beaucoup d'analogues en France.

En lisant ce volume avec soin, j'ai trouvé en plusieurs points quelques détails nouveaux, quelques petits changements de mes pratiques personnelles. Non seulement je n'ai pas d'objections à faire à l'auteur sur ces points, mais je l'en remercie. Si une pratique aussi vaste que celle du traitement applicable à toutes les fractures ne pouvait supporter de petites modifications, ce ne serait plus une *méthode*, ce serait un *procédé*. Une méthode digne de ce nom doit pouvoir supporter toutes les adaptations personnelles, doit s'accommoder au tempérament du chirurgien et même à ses aptitudes. C'est ainsi qu'en respectant les principes fondamentaux on pourra toujours la perfectionner.

L'origine de ce livre excellent est un encouragement et un exemple précieux donné par l'auteur qui a commencé par étudier les principes, par comprendre la méthode seulement au point de vue scientifique. Puis il a pu entrer dans cette pratique spéciale sans avoir jamais vu opérer ni moi ni un de mes élèves. Enfin il a abordé l'exercice de la méthode sans avoir antérieurement fait de massage. Je tiens à le faire remarquer parce que je professe que c'est là la meilleure condition de succès. Le massage tel que je l'ai

institué diffère tellement des manœuvres généralement comprises sous le nom de massage que tous ceux qui étaient masseurs de profession ont quelque peine à renoncer à leurs habitudes.

Mon assistant Dagron a donné la meilleure démonstration de cette différence en appliquant plus tard à beaucoup d'autres conditions pathologiques les manœuvres douces progressives anesthésiantes que j'avais inaugurées pour les fractures, et il en a obtenu des résultats inconnus jusque-là.

Les données fondamentales sur lesquelles toute pratique du traitement des fractures doit être établie peuvent être résumées de la façon suivante :—

“ L'immobilisation absolue des fragments osseux n'est pas la condition la plus favorable à leur réparation.

“ Une certaine dose de mouvements des fragments est la meilleure condition de la réparation du foyer osseux de fracture.

“ Une mobilisation dosée et le massage donnent les conditions les plus parfaites de la réparation des membres.

“ La mobilisation et le massage, en agissant sur la douleur et sur les contractures musculaires, jouent dans la réparation un rôle capital que rien ne peut remplacer.

## 4 TREATMENT OF FRACTURES

“ Un grand nombre de déformations dues aux contractures disparaissent spontanément par cessation des contractures après le massage et la mobilisation.

“ La suppression de la douleur par le massage et le mouvement est un élément essentiel du traitement des fractures.

“ La constriction par les appareils et l'immobilisation doivent être considérées comme des pratiques nuisibles à la réparation des membres qui ont subi un traumatisme.

“ Le retour parfait des fonctions du membre n'est pas du tout en relation directe avec le rétablissement exact de la forme et surtout de la longueur du membre.

“ Certains raccourcissements du membre sont favorables à la réparation musculaire.

“ La réparation parfaite après le traumatisme dépend moins du rétablissement absolu de la forme que du retour rapide du mouvement qui favorise la vie des articulations, tendons, muscles, nerfs, et vaisseaux du membre.

“ La privation du mouvement même pour de courtes périodes, surtout après les traumatismes articulaires, engendre des lésions dont quelques unes ne seront jamais réparées.”

Cette méthode est tellement en opposition avec les principes enseignés, elle est tellement

paradoxe relativement aux connaissances les plus anciennement admises, qu'il faut une métamorphose complète dans les pratiques connues pour l'appliquer.

Depuis quelques années il est vrai l'application rigoureuse des appareils a été un peu modifiée. Sous l'influence de nos publications on a introduit plus largement le massage et la rééducation musculaire dans le traitement des fractures. Malgré cela, la pratique est encore soumise à un abus extraordinaire des appareils immobilisateurs ; et le principe du mouvement immédiat est bien loin d'être généralisé.

Pour un certain nombre de fractures ma méthode se trouve encore en concurrence avec la pratique nouvelle du traitement opératoire des fractures fermées et sur certains points nettement en opposition avec cette méthode.

Je ne méconnais pas l'œuvre admirable accomplie par les chirurgiens qui nous ont montré la possibilité du succès et nous ont doté d'excellentes techniques pour ces opérations. En certains cas spéciaux elles peuvent donner des résultats que l'on n'avait jamais atteints. Mais je pense que cette méthode est destinée à rester limitée à certains cas. Si précieuse qu'elle soit, sa pratique est fondée sur des principes qui ne sont pas exacts et que l'observation clinique ne justifie pas.

## 6 TREATMENT OF FRACTURES

Quels sont en substance ces principes ?

La réduction absolue de la déformation est indispensable au rétablissement de la fonction.

L'immobilisation absolue des fragments est la meilleure condition de réparation de l'os.

L'immobilisation nécessaire à cette guérison est sans inconvénients pour l'avenir des fonctions.

La sécurité de l'opération et la possibilité constante de son exécution sont hors de doute.

Or, ces principes sont inexacts. Il suffit de pratiquer ma méthode même pendant un temps très court pour bien se rendre compte du fait qu'il est facile de démontrer l'inexactitude des trois premières propositions.

Quant à la sécurité, elle ne peut être que relative. Elle dépend exclusivement de l'habileté opératoire du chirurgien et d'un matériel irréprochable. A côté des beaux succès des Maîtres qui ont pratiqué ces opérations il ne faut pas oublier les insuccès et même les désastres survenus entre les mains d'un certain nombre de leurs imitateurs.

Sans doute après que Lister par ses découvertes nous eut donné la liberté opératoire, l'ouverture des fractures trouvait sa place au même titre que bien d'autres opérations. Lister lui-même nous en a donné l'exemple. Mais comme pour

d'autres opérations la facilité de l'opération l'a fait généraliser hâtivement, et, comme pour d'autres opérations, l'expérience limitera plus justement son rôle.

Je puis le dire plus librement qu'un autre. J'ai vu naître tant d'opérations que ma tendance personnelle irait plutôt à les multiplier comme on me l'a reproché.

Mais, pour qu'une méthode subsiste et se généralise, il ne suffit pas qu'elle soit possible. Il ne suffit pas que l'opération soit réalisable, ni même qu'elle donne un bon résultat. Il faut qu'elle donne des résultats supérieurs sur tous les points suivants :—

Moins de douleur ;

Durée de réparation plus courte ;

Fonctions plus parfaites ;

Retour plus rapide à des fonctions définitives,

qui ne risquent plus d'être troublées ;

Sécurité plus grande.

Or, quoiqu'il soit bien vrai que l'opération des fractures fermées a donné, pour beaucoup de cas, des résultats supérieurs à ceux que donnait un traitement par les appareils inamovibles avec de longues immobilisations ou manœuvres brutales, il n'est pas moins vrai que, pour beaucoup de cas, elle ne peut supporter la comparaison avec le traitement par le massage et la mobilisation.

Si je n'accepte pas sa généralisation ce n'est ni par répugnance contre l'opération, ni par impuissance à l'appliquer. Mais je n'ai voulu l'appliquer que dans les cas dans lesquels je constatai sa supériorité. J'en ai donné l'exemple suivant tiré de ma pratique et qui me paraît très précis :—

Après Hector Cameron et Lister, j'ai été des premiers à ouvrir largement le genou pour faire la suture de la rotule fracturée, et, depuis cette époque lointaine, je l'ai toujours faite sauf pour les sujets diabétiques.

Pour les fractures de l'olécrane que j'ai pu traiter immédiatement je ne l'ai *jamais* faite, parce que j'ai eu par le massage des résultats si rapides, si simples et si complets que la supériorité de ma pratique m'a paru satisfaisante. Cependant j'ai eu occasion de faire la même suture pour des cas anciens qui ne me paraissaient plus justifiables de mon traitement de mobilisation. Pour la même raison je n'ai jamais fait de suture immédiate de clavicule fracturée tandis que j'en ai fait plusieurs pour des fractures anciennes.

Je suis donc bien convaincu que l'opération restera, avec des indications déterminées, souvent même limitée à certains chirurgiens particulièrement habiles, tandis que le traitement que Dr. James Mennell expose après moi sera susceptible d'une généralisation complète.

Pourtant il ne faudrait pas croire que cette généralisation pût être livrée à la fantaisie des imitateurs. Il sera nécessaire de ne pas s'écartier de certains principes fondamentaux. Il ne faudrait pas que s'appuyant uniquement sur cette observation, que j'ai bien mise en relief, que le mouvement est favorable à la réparation des membres fracturés on leur appliquât un mouvement quelconque.

La méthode doit être précisée avec soin comme l'a fait Dr. James Mennell. Elle demande une intervention personnelle attentive pour appliquer les principes que nous avons énumérés sans s'écartier des conditions suivantes :—

La mobilisation doit toujours être dosée et progressive ;

L'intervention du chirurgien doit être aussi prompte que possible après l'accident ;

Le traitement ne doit jamais déterminer de douleur ;

Au cours de la mobilisation ce n'est pas l'amplitude des mouvements qu'il faut chercher mais leur multiplicité ;

Le traitement doit varier avec le sujet, s'adapter à son âge, aux variétés de fractures, aux conditions du traumatisme, et de la sensibilité individuelle.

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Par cette méthode, le chirurgien peut et doit obtenir des résultats très supérieurs à ceux que donne l'immobilisation. Mais il ne les obtiendra qu'en consacrant aux blessés beaucoup plus de soin et de surveillance qu'on n'a coutume de le faire pour l'application des appareils inamovibles.

*Sacar-Championné*



# CHAPTER I

## GENERAL CONSIDERATIONS

I MAKE no apology for inviting attention to a mode of treatment which has met with little favour in this country. That it has not been more freely adopted appears to be due to two facts. First, the methods advocated are diametrically opposed to the traditional teaching ; second, the newer method has not been studied and is therefore unappreciated.

It is not generally claimed that the results obtained by treatment of fractures on the accepted lines are so satisfactory as to need no amendment ; on the contrary, in all recent literature on the subject there is found a tendency to take a pessimistic view of our present style of achievement. No writer is apt to form a more gloomy prognosis of simple fracture than Mr. Clinton Dent. He has stated that “a fracture of a leg is, in its after-effects, a very serious injury,” and that very few members of the Metropolitan Police Force who

have suffered fracture of both Tibia and Fibula return to work in less than six months, many, moreover, breaking down on resuming work and becoming “permanently incapable” of resuming their employment. He estimates that 30 per cent. *never* resume work: fracture involving knee, ankle, or Femur leads uniformly to permanent unfitness. Other fractures Mr. Clinton Dent regards as only less fatal in their effect of crippling the patient.

Sir Alfred Pearce Gould sums up the necessity for reform by saying that “the treatment of simple fractures is but little better or more successful to-day than it was a generation ago”; and that, while in other directions surgery has advanced as a broad and rapid stream, the treatment of fractures “seems to have got into a quiet—almost stagnant—backwater.” The truth of this statement is borne out by the literature on the subject. In the library of the Royal College of Surgeons there are only eleven books published in England and America during the last fifty years on the subject of fractures. Of these only three appear to suggest any material advance in the science. These are Sir William Bennett’s and Dr. Wharton Hood’s books—containing little more than a hundred pages between them on the treatment of fractures—and Mr. Lane’s

treatise on operative treatment. Again, the paucity of literature in the form of original articles, if we exclude those by the authors mentioned and by Professor Lucas-Championnière, is most striking. Such as there are mainly consist of eulogia of the classical or the operative treatments, or of various methods of splintage, internal and external. Otherwise they seem to contain little more than occasional, and often almost valueless, suggestions with regard to minute details.

Mr. Lane, again, is emphatic enough : “ The treatment of fractures, as it exists at the present, is a disgrace to surgical practice.”

Secondly, the disrepute in which the use of massage and mobilisation in the treatment of fractures is held in this country is largely due to ignorance of Professor Lucas-Championnière’s methods. The patient is usually placed under the care of a masseur who has no special knowledge or experience to guide him ; and who, however expert he may be in the performance of ordinary massage work, is absolutely ignorant of the elements of the Professor’s teaching. Indeed, the majority of trained masseurs are found to scoff openly at the methods advocated, and, not unnaturally, fail lamentably to attain success ; inflicting prolonged

agony, and ultimately, perhaps, irreparable injury on their patients.

The result has been that the method has been condemned, and with justice, since the treatment meted out to the unfortunate patients has been one evolved by the masseurs, which, so far from resembling that of Professor Lucas-Championnière, is its exact antithesis in all essential details. Thus it has come about that the true method has been condemned by critics, few of whom have given it personal trial.

Professor Lucas-Championnière strongly deprecates the idea that the treatment of fractures may be left in the hands of the ordinary masseur. Were it necessary so to leave it, he says very plainly that he would be the first to advocate the continuance of the older methods of treatment as entailing less risk of injury to the patient than would be involved by massage at the hands of most of its professors.

The most emphatic condemnation of the new method is based upon the appalling results of massage in cases of supposed sprains, which have proved to be cases of fracture. Obviously, such fractures can only be of the mildest possible form, and yet many evils are stated to have followed the treatment. It may be asserted

with confidence that such evils have been due solely to the faulty technique of the practitioner. Massage is recognised as a useful method of treating sprains, and has yielded good results : how much better and more rapid such results might be is not generally realised. Massage, as commonly understood and practised at the present day, is far too violent to obtain the best results in cases of recent injury, be they sprains or fractures. The painless massage—the “glucokinesis” to be referred to presently—is the correct treatment for all recent injury where massage is applicable : were this the massage of general use instead of the deep pressures, kneadings and forced movements, by which it is commonly represented, the benefits of massage would be more widely recognised, and the treatment would be cleared of the suspicion by which it is now prejudiced. Nothing but good could possibly come of the treatment of sprains, complicated by fracture or not, by glucokinesis.

If such massage be employed, the presence or absence of fracture is, in many cases, of no importance. Take as examples such cases as fractures of the shaft of the Fibula, impacted fractures of the lower end of the Radius without displacement, many of the so-called “fissure-

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fractures," where there is no displacement—such cases, in fact, as are diagnosed as sprains in default of definite evidence of fracture, correct diagnosis being revealed only by the X-rays.

As a last argument in favour of introducing a radical change in the routine treatment of fractures, it has been truly said that on no occasion does a medical man run a greater risk of damaging his professional reputation than when he undertakes the treatment of a simple fracture on conventional lines ; since it would appear that the majority of accusations brought in the courts against medical men concern the treatment of fractures.

Mr. Lane, indeed, has made an advance in treatment worthy of a great surgeon ; but, unfortunately, the treatment of fractures cannot but continue, in an overwhelming majority of cases, in the hands of the general practitioner. Much benefit may be derived by the fortunate few to whose cases Mr. Lane's treatment may be applied by surgeons who are competent : but woe betide the many whose surgeons, for this purpose, are otherwise ! And for every ten cases for which operative treatment can be obtained, there must always remain thousands for which it cannot, merely by reason of the

inadequacy of the number of surgeons sufficiently skilled to undertake such operations with safety.

It was in the hope that a few members of the unfortunate majority might receive treatment less unworthy of modern surgical science that the first experiments were made in the treatment advocated in this work. In what degree the experiment was justified by results will appear later. The writer's earliest efforts were met with the ridicule which attends innovation: he had the satisfaction of seeing it soften into the interest which provokes argument. A few witnesses of the results even flattered by imitation; but the stress of a house-officer's life seldom allows him time to indulge himself or his patients with novelties.

## CHAPTER II

### DEFINITIONS

WHEN Professor Lucas-Championnière read a paper on the treatment of fractures by mobilisation and massage before the Moscow Congress in 1897, Dr. Zabludowski, the “king of German masseurs,” stated that “massage become painless ceases to be massage, and is merely treatment by suggestion.” If such indeed is the nature of massage, it is not massage that is advocated in this book ; but I know not how else to name it ; unless we adopt the Professor’s own title “glucokinesis.”

Having watched the procedure of massage experts of four nationalities I have been forced to the conclusion that the majority of them would endorse Dr. Zabludowski’s opinion. Indeed, one of their number, a highly proficient Swedish masseuse, confirmed it by stating that, in her opinion, no benefit could be expected to result from massage treatment that was unaccompanied by pain. Their guiding rule has

often appeared to me to be "give the patient as much as he can stand." Such, too, would seem to be the opinion of the general public, who deem that, to use the words of a famous French masseur quoted by Professor Lucas-Championnière, a masseur must needs be "tall, strong, and vigorous," in order that he may have sufficient physical power to carry out the treatment satisfactorily. It is difficult to imagine qualities less essential to any who would carry out the treatment advocated in these pages. A personal note may serve to illustrate my meaning. For months on end my morning work has consisted of massage for five or six hours daily without a break, six days a week, a feat I should suppose to be impossible had the massage employed been such as is in general use at the present day.

The prime test of the success of massage as applied to a recent fracture is the relief of pain. That relief may be given immediately after fracture will be seen from the following personal experiences. The first case I demonstrated was that of a woman of sixty, who fell down a flight of stone steps and fractured her Olecranon. She was brought to Hospital at once, and was so shaken that she could not stand, but sat in a chair groaning, apparently speechless. All

attempts to examine the injured arm were greeted with shrieks of pain. After a quarter of an hour's massage the pain had completely vanished, leaving only acute tenderness about the elbow region ; while the upper fragment could be seized and its free mobility demonstrated without opposition. She was sent home, and enjoyed a good night's rest.

A notable case was that of a stout female of advanced age who was brought to Hospital with a fracture of the lower third of the Femur, the lower fragment being freely mobile. While lying on the couch she suffered exquisitely from repeated attacks of cramp in the injured thigh. I took the opportunity, afforded by a brief delay in her removal to the ward, to apply massage. In a few minutes the cramps had entirely ceased, and shortly afterwards she was quite comfortable, and remained almost free from pain until manipulation became necessary for the application of a splint, prior to her removal to the ward.

I have also had the opportunity of removing a long-outside splint from the leg of a girl, aged eleven, who had sustained a fracture of the middle of the shaft of the Femur. A flannel extension was then bandaged on, and the limb placed between sand-bags. During the neces-

sarily prolonged manipulation the patient only cried out twice, as, thanks to continuous massage, the whole proceeding was rendered practically painless. Thereafter, up to the time of operation—the bone was plated—this patient suffered severe pain at intervals. It appeared to be worse at night. The only relief she obtained was due to massage, by means of which I was able not only to remove pain but also actually to send her to sleep during the process of the rubbing. Many of my out-patients have told me that they went straight home from Hospital after their massage in order to go to sleep while still free from pain. Sir William Bennett quotes two cases of fractured Femur in which similar results were obtained. He adds that in one case the patient fell asleep during the massage—the first sleep she had obtained for two days in spite of narcotics.

No useful purpose is served by multiplying examples; and it will suffice to say that immediate relief of pain should never fail to follow massage treatment. The cessation of pain—the “anesthésie” of Lucas-Championnière—alone should be held to indicate that massage has been successful, and that the time has arrived to proceed to mobilisation.

In my notes of the first visits of patients, as a

rule on the day after that of the accident, I find “has had great pain,” “has had no sleep,” and so on ; the following day “pain slight” or “slept well.” Later, in a few cases, “has not attended for (three) days : pain severe.” The trained masseur, with no previous experience in the treatment of recent fractures, would rarely, if ever, obtain these results ; while those who agree with Dr. Zabludowski would probably do far more harm than good.

The main action that is used for the relief of pain is referred to by Professor Lucas-Championnière as “massage en bracelet,” while my instructions to patients, when first they are allowed to massage the injured part at home, are “to rub it gently, as if they were stroking a cat.”

But the desired end is obtained not so much by the use of any specialised movements as by the slow and rhythmical repetition of a single movement, which, whatever may be the nature of the movement, is “little more than a caress,” performed with uniform speed and monotonous regularity ; the only permissible change, as the pain passes away, being the slightest possible, but regularly progressive, increase of pressure ; but—perhaps the most important point of all—without the smallest deviation in direction.

This should, generally speaking, be from a distant to a proximal point, following the lines of the underlying muscles or the venous flow.

Recently I have been responsible for the after-treatment of a case of amputation through the middle third of the thigh. Pain was relieved almost instantly by massage from above downwards. Only the most gentle "glucokinesis" was performed.

Massage, as usually practised, includes various movements across the line of the axis of the muscles, and even in a direction directly contrary to the venous flow. We are not concerned, at present, with criticisms of the accepted forms of massage; and it will suffice to say here that it is hard to imagine any condition in which the last-described movement could be expected to act beneficially, except during massage for the relief of pain in very exceptional cases, probably only after amputation, and that the movements across the line of axis of the muscles should be used only in the attempt to break or to stretch adhesions. In the treatment of any recent injury such movements are useless: in the treatment of fractures they are dangerous, and should be entirely avoided.

After union is complete, a gradual transition may be made to any of the more generally accepted methods of gentle massage, but, even then, the greatest care must be exercised. If the treatment has been efficiently carried out, there will be no temptation to practise any of the heavier forms of massage. These may have their uses in other conditions, but never in cases of fracture treated by massage and mobilisation from the outset. Professor Lucas-Championnière's advice runs :—“ Do not bewilder yourself with the terrifying nomenclature of the manœuvres of massage . . . effleurage, pétrissage, tapotements, pincements, etc. . . . So far as fractures are concerned, there is no need to depart from perfectly simple movements.”

The principle first to be impressed upon anyone proposing to treat a fracture for the first time by mobilisation and massage is :—“ Never be afraid of rubbing too gently, or of giving too small a dose of mobilisation : always fear that the massage is too heavy and the movement too great.” So light should be the touch, so gentle the stroking, that actual contact between hand and injured part is almost imperceptible to patient and practitioner alike.

“ Mobilisation ” is a term which also calls for

examination, since it seems to be commonly understood, in connection with fractures, to connote entire absence of restriction of use or movement ; the patient being allowed, in fact, to wave a fractured arm about promiscuously, or to walk on a leg which has sustained fracture before union is complete. Even those who have given the subject serious consideration seem to labour under the delusion that the use of the term "Mobilisation" indicates that full movement is at once bestowed on every joint in the affected limb. A delusion indeed it is.

Mobilisation must be regarded in the light of a therapeutic measure, the "dose" of which is regulated by the nature of the complaint it is calculated to cure. Thus, for a recent fracture of the surgical neck of the Humerus, the treatment is limited, on the first day, to free movements of the fingers and wrist, half movement at the elbow, and only such movement at the shoulder as is unavoidable during these manipulations. But in a week's time abduction, flexion, and extension of the arm should reach  $50^{\circ}/_{\circ}-75^{\circ}/_{\circ}$ , and a minute amount of rotation may be called for, in suitable cases, before a sufficient dose has been administered.

There is only one limit to the amount of this

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dose : it must cause no pain. With experience it is possible to measure the dose with great accuracy, the patient's expression affording a safe indication when the limit has been reached. The movement, while painless, seems to please ; but, as the amplitude increases, an anxious expression appears quite suddenly, and the limit is reached. At the same time there is a slight twitching of a muscle, readily detected after a short experience, but it is very slight indeed unless the limit has been passed, in which case it is transformed into a sudden and painful spasm, the face being, at the same time, convulsed.

It is essential to bear in mind that the relief caused by massage must always be so profound that not only should no movements here recommended cause any pain, but even movements of a wholly undesirable and possibly dangerous amplitude might be performed painlessly. If, then, pain should be felt during mobilisation, massage has been inefficient and should be instantly resumed. If, in spite of perseverance and faultless technique, painless movement proves impracticable, all attempts to obtain it should cease.

As will be seen later, the use of splints is not to be altogether abandoned in the treatment of the

majority of fractures. Unfortunately, a splintless treatment is an unattainable ideal. As soon as possible splints are discarded, though it is often necessary to leave them *in situ* for a short space. In these cases a mixed method of treatment is adopted, massage and mobilisation being practised daily after only a brief delay, the splints being applied between whiles.

There is a general belief in this country that Professor Lucas-Championnière would wish to omit the use of splints entirely from the routine treatment of fractures. That this is a false conception of his teaching is shown by the fact that, in his book, he divides fractures—for the purpose of treatment by massage—into four classes. In only one, and that perhaps the smallest of the four, does he advise that no apparatus should be used.

For example, in such cases as Pott's fracture with much displacement, should the displacement fail to reduce as the result of mobilisation and massage, massage should be applied, reduction carried out under an anæsthetic, and the parts should then be retained in position by a suitable splint, usually plaster of Paris. Union will be sufficiently firm by the end of a week of immobilisation for the removal of the splints daily while movements and massage

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are administered. At the end of another week or ten days they may be discarded altogether. Any essential reduction which such methods fail to effect must be performed by open operation.

## CHAPTER III

### THE PATHOLOGY OF THE EFFECTS OF MOBILISATION

THE fundamental doctrine of the treatment of fractures, as generally accepted at the present day, may be summed up in the word "immobilisation." The only ground on which that doctrine can claim respect is that it is old, not to say antiquated. In fact, it is prehistoric. The writer has seen the mummified remains of the fore-arm of an ancient Egyptian, in which both bones had been broken, applied to a splint.

M. Manouvrier, an eminent anthropologist, on finding in a cave bones which showed the seat of repaired fractures, concluded that men of the stone age had arrived at the surgical conception of fixation by apparatus. The possibility of repair apart from such means seemingly did not occur to him. Nevertheless the evidence is inconclusive, since we know that the bones of animals unite firmly without the use of splints. In fact, the natural treat-

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ment of a broken bone, as illustrated by the dog, is to lick the injured limb gently ; a process which after all closely resembles the treatment advised in the preceding chapter. It is possible, therefore, if improbable, that prehistoric man may have treated similar injuries by rubbing. In recent times, before the introduction of the X-rays, many a fracture must have been treated all unwittingly by mobilisation and massage. Even at the present time many cases are first treated by linaments and other applications for a few days, after which, if recovery be slow, recourse is had to X-ray examination ; whereafter, fracture being reported, the unfortunate patient is clapped into splints for a quite outrageous period, with the idea, we must suppose, of preventing movement on the part of fragments which have already failed to move in spite of vigorous rubbings and, perhaps, of the almost normal use of the limb.

Or take the case of a fractured Femur treated by extension. No steps are taken to immobilise the pelvis, so that free mobility of the upper fragment is allowed ; even admitting, what is very doubtful, that the lower fragment is immobilised. A compound fracture, too, is often left on a very inefficient splint, from the standpoint of immobilisation, in order that

dressings may be applied. The dressing itself, however carefully it may be done, involves some degree of movement. Yet these forms of fracture are well known to unite ; and it is hard to understand why a rigid immobilisation should be considered essential for the union of precisely similar fractures, merely because the skin happens to be unbroken.

When a bone is broken there is invariably some œdema at and around the site of fracture. If we bear in mind that a fracture of the external Malleolus almost invariably causes intense œdema of the foot, although the foot itself be uninjured ; and that a fracture of the surgical neck of the Humerus, or even of the Clavicle, may cause an intense œdema of the whole limb to the finger-tips, we are driven to the conclusion that there is some interference with the circulatory system of the part affected.

There are several possible explanations of the œdema that follows fracture. It may be due to the loss of pressure on the veins, due to the temporary loss of muscular contraction, retarding the removal of lymph from the tissues ; it may be due to hæmorrhage from ruptured vessels ; it may be due to mechanical obstruction of the venous return. This last can, from the general conditions obtaining after

fracture, operate only in exceptional cases. In some cases the œdema might result from a combination of the above causes, a view strongly held by Dr. Wharton Hood. It will be obvious that the pressure involved by the ordinary methods of external splintage may soon add another important factor.

I cannot think that the loss of pressure on the veins suffices as the principal cause of the œdema and swelling which occur after fracture. A patient recently under observation had sustained at least three distinct fractures of his Fibula, as the result of slipping off the pavement. The morning after the accident his leg was as large in the middle of the calf as his thigh in its upper third. It nearly resembled the condition seen in advanced stages of heart disease, or even of lardaceous disease ; but with this difference, that the swelling was sharply limited at the level of the knee. There was no such direct injury of vessels as would have occurred had the limb been crushed : the laceration of tissue can have been but slight, and the veins had been deprived of external pressure only for the space of a few hours. Yet I have never seen a more intense œdema, and some further explanation of the swelling is needed. The only remaining explanation is that there

was some vaso-motor disturbance in the limb. Professor Lucas-Championnière refers somewhat indefinitely to such a possibility, and this is, as I think, the one tenable explanation of the origin of œdema after fracture of the lower end of the Radius. Taking only those cases where reduction has been practised, experience has led the writer to expect that if the patient is an aged woman the œdema will be greater than if she is in the prime of life ; while in children the so-called separation of the lower epiphysis of the Radius causes only a very transitory swelling, in spite of the fact that the displacement is usually great and reduction effected only by considerable force. If, as I understand to be the case, vaso-motor disturbance is transitory in children and prolonged in the aged, we have here an explanation of the œdema seen after these fractures which covers the clinical facts more readily than any of those quoted. Further reference will be made to this subject when we come to consider the results obtained by massage.

We are now in a position to contrast the two methods of treatment, massage *versus* immobilisation. If massage is applied early the œdema is never so intense as when there is delay, and the rapidity with which it disappears is striking.

If massage be delayed, not only is the œdema more intense, but it is of a thick, doughy consistency, and yields only to prolonged treatment. The explanation must surely be that by the massage the normal circulation of the limb is restored. Histological investigation tends to confirm this supposition, as will appear.

When splintage is applied to a broken limb, not only are no steps taken to restore the circulation, but a condition of total disuse is enforced, which, since of disuse comes atrophy, must itself lead to further loss of vitality. Even a healthy bone tends to undergo atrophy, and that so rapidly that Dr. Emile Pillet, in a thesis on spontaneous fracture, has stated that the bones of a child's limb which has been placed in plaster are liable to undergo spontaneous fracture after the second month. That external splintage fails to restore circulation is also shown clinically by the fact that a leg still shows signs of œdema when a plaster splint is removed a month or six weeks after fracture. Moreover, a patient's first attempt—however cautious—to walk often causes a swelling of the limb, which may return as much as six months afterwards as the result of exertion. On removal of the splint, therefore, when treatment by strict immobilisation has

been carried out, the limb may be strong but it is not cured.

With patients beginning to walk after treatment by mobilisation and massage this complication of convalescence is transitory, if present at all. It may be said that persistent œdema never occurs, unless the newly-gained freedom is abused. That is to say, when the limb is strong enough for use the cure is complete. This will be made clear when the estimated duration of convalescence, as given later, is considered. For the moment it will suffice to quote one case, that of a messenger-boy who had sustained a Pott's fracture and, in addition, had a small piece of bone torn off the back of his Tibia, a fracture which also involved the ankle-joint. He went back to work at the end of four weeks and reported a fortnight later at Hospital. He had suffered no pain whatsoever, nor had there been any swelling after the first two or three days. This is not cited as an average result, though experience has done much to show that there is in it nothing extraordinary ; the point here emphasised is that the boy had recovered full use of his limb directly it was strong enough to bear his weight. Such recovery is impossible without massage.

Fracture of a bone is a severe injury, and

pathology teaches that repair after injury is more rapid where there is a generous supply of blood than where the supply is poor. An illustration of this law appears when we proceed to treat fractures of the Humerus.

Crepitus is felt, as a rule, up to the twelfth day after a fracture through the shaft; but it has usually disappeared completely by the end of a week when the surgical neck is involved, although the bone in this position has a wider cross-section. This more rapid union can only be attributed to the greater vascularity of the upper end of the bone as compared with the middle. Such relative rapidity of union is found in the case of all long bones; and accounts, in part at any rate, for the fact that fractures of the Clavicle, a bone where the vascularity is particularly good, rarely fail to unite, while fractures of the ribs, where the same condition obtains, never fail to do so. Another example is furnished by fractures of both fore-arm bones, the Radius, the lower end of which is more vascular than the corresponding point on the Ulna, being invariably found to unite several days the earlier of the two.

If this be the true explanation, it follows that a broken bone will unite more rapidly in a limb where the circulation has been restored by

massage than in one where the enfeeblement of circulation is allowed to persist. That the callus ossifies more quickly I have been able in some measure to prove by radiography. Ossified callus is not, as a rule, seen on a skiagram before the end of the fourth, or even of the fifth, week. Several cases treated by massage have displayed such ossification in an advanced stage at the end of three weeks.

In all probability the rapidity of the formation and ossification of callus is due largely to mobilisation, but, be that as it may, the fact is incontestable that callus is formed more rapidly when movement is allowed than when it is withheld.

It must be clearly understood that the movement referred to is not movement deliberately imparted to the fragments at the site of fracture, but movement imparted to neighbouring joints, and thereby to the muscles and soft structures immediately adjacent to the fracture; that is, the so-called "internal massage." Incidentally, some movement is imparted to the bony fragments and the fractured surfaces are thus made to grate on each other: it is so that crepitus is occasionally felt. But this movement is incidental, being the inevitable result of treatment. Far from being obtained deliberately, it is rather

reduced to a minimum ; though it forms at the same time an essential and integral part of the treatment.

For this movement between the fragments, though so slight, plays by no means a useless part in the work of union. The one and only place in the whole body where, if a fracture is sustained, we can state with certainty that the treatment is one of absolute immobilisation, is the skull ; for no method of splintage, external, or, in most cases, internal, is so perfect as to prohibit all movement between the fragments. A visit to the surgical section of any large museum will show the frequency with which fractures of the skull fail to unite in spite of immobilisation, while, as already stated, a broken rib never fails to unite, not in spite of, but because of, incessant mobilisation.

Moreover, cases are reported where treatment by internal splintage, though eminently successful as far as the operative procedure was concerned, have proved far from satisfactory, owing to the poor quality and meagre quantity of the callus formation. Thus, in the case already referred to of the little girl who had sustained a fracture through the middle third of her Femur, a plate was applied with all possible apparent success. At the time of operation the fragments dove-

tailed into each other with the utmost nicety, the result being that "play" between the fragments was practically abolished. A long plate was applied, and the screws were well away from the region of callus-formation. At the time of writing, some six months after operation, the bone is showing obvious signs of bending. Had the operation been less successful; had immobility been less perfect; had the operation been performed at a later date when the young callus-formation was well advanced; had the screws even been in a position to act as a foreign body in the growing callus—then the callus formed would have been greater in quantity and better in quality, and the subsequent bending would never have taken place.

A "weak union" and bending at the sight of union are no uncommon features of fracture-cases which have been treated on the usual lines; yet not one of four hundred odd cases treated by movement and massage has presented the smallest indication of danger in these directions. Not a few have, on the other hand, displayed a marked formation of superabundant callus, of a quality beyond reproach.

Professor Lucas-Championnière goes so far as to affirm that some movement is *essential* to the formation of healthy callus, basing his opinion

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on evidence very similar to that now adduced. He holds that "movement is a fundamental and necessary condition of the life and repair of bone, while immobility is detrimental to the proper development of callus."

Mr. Arbuthnot Lane's views form an interesting contrast. The fundamental doctrine in his "Operative treatment of Fractures" is the desirability of restoring a fractured bone to its true form ; but this is always coupled with the suggestion, expressed or implied, that immobility must also be attained. He quotes a case in which "it was necessary to use three long steel screws passed in different directions in order to secure perfect apposition and complete immobility of the fragments." Presumably fixation was absolute, and there can be no doubt that such was the operator's intention. He also states that "rarefying osteitis"—a common sequel to operations on fractures in the experience of some surgeons—"occurs from injection of the wound due to the want of proper precautions, *or to the use of some mechanism that does not immobilise the fragments.*"

The rarefying osteitis not infrequently occurs in the neighbourhood of the screws used for fixing a plate to a fractured bone, although the contiguous extremities of the fractured bone

may unite firmly by means of healthy callus ; and it seems a not unnatural consequence of the irritation caused by the constant "wobbling" of the screws when mobility has been present. In such cases a second operation is needed for the removal of the screws—an expedient to be avoided : hence, if for no other reason, the desirability of complete fixation if operative procedure is undertaken.

Thus far the position is that absolute fixation is desirable in all operative procedure, in spite of the fact that some movement is most desirable to aid the formation of callus, and that operation, in skilful hands, yields most excellent results. Yet a very limited experience will teach that immobility is not enforced in many cases that undergo operation. Take, for example, a fractured Femur. Is it credible that a long, narrow plate fixed along one side of the bone is able to prevent some "play" between the fragments ? It is supposed that these plates are rigid, but that they fail to impose rigidity on a bone, when so applied, is abundantly obvious in practice. When rigidity is obtained, some other factor is present. This usually takes the form of serration of the edges ; and these edges, by dove-tailing into each other, provide a kind of accessory splintage

throughout the circumference of the bone, which, together with the lateral plate, effectively prevents all movement, unless it be a tendency to gape on the side of the bone remote from the plate. These cases, however, are of the type in which the callus formed is small in quantity and meagre in quality, permitting such sequelæ as bending at the site of union.

The amount of movement between the fragments of a broken bone which is beneficial is very small ; and fixation by operative means, if not absolute, allows a sufficiency of movement for the formation of healthy callus. Hence the success of many operation cases.

But it is indisputable that callus, satisfactory in quality and quantity, may be formed after operation in spite of absolute fixation. This admission does not detract from the value of the evidence adduced to show that mobility is beneficial to the formation of healthy callus ; since, in operation cases, other factors are present which materially affect the callus-formation. We may compare the fine granulation tissue, the precursor of true callus, to embryonic tissue, and it is a matter of common knowledge that such tissue responds to mechanical stimulation by enormous activity. At operation, if performed some time after fracture, this granulation

tissue undergoes such stimulation to a very marked degree ; and the more of the tissue there is present to receive the stimulation the less is the necessity for "play" between the fragments to assist the formation of the callus. Moreover, in many cases, an additional stimulus is added, as in the case quoted where three screws were needed to fix the fragments, by the presence of a foreign body piercing through the newly-formed tissue.

Such, at any rate, is the only explanation which seems to account for the occurrence of an excessive callus-formation in the following case. The patient had suffered a fracture of the upper third of both Femur and Humerus of the right side, as the result of a railway accident. Long plates were applied to both bones after some considerable time had elapsed, and the patient made a rapid and complete recovery. I have never seen so free a formation of callus as took place at the site of both fractures, not even in the cases to be mentioned immediately. Particularly was this so in the neighbourhood of the Humerus, which was plated several days later than the Femur. It was far more excessive than in any of the cases treated by mobilisation, and it would appear, therefore, that the "play" allowed between the fragments in the absence

of perfect fixation cannot be held responsible ; since, of necessity, the amount of movement allowed is slight in operation cases, as compared with that which takes place in those treated according to the method which is to be particularised later. If the excessive formation was not due to mobility, it can only have been due to some stimulus imparted at the time of operation, or to the more permanent stimulus of the presence of a foreign body in the midst of the young, growing tissue. If the sites of fracture were perforated by screws, doubtless both causes were operative.

As a contrast let us consider the result of resection of both bones of the fore-arm. It is fairly well recognised that after this operation union is very liable to be faulty or absent. In such cases the fracture is recent : there is no recently-formed granulation tissue present to receive stimulus from the manipulations. The fractures being transverse, the screws do not encroach upon the site of fracture : the stimulus due to the presence of a foreign body is absent. The presence of a plate on the outer side of the Radius, with another on the inner side of the Ulna, imposes immobility : the stimulus due to movement is lacking. In the absence of all three causes of stimulation the callus-formation

is poor, both as regards quality and quantity, and union is deficient.

A final point is mentioned for what it is worth. At operation the manipulations are such as must often tear the periosteum from the surface of the bone to a greater extent than did the original fracture. Thus is added an accessory stimulus which is absent in all cases of osteotomy.

In a recent work the statement is made that "cases of re-fracture are not uncommon" when treatment by mobilisation and massage is undertaken, the implication being that the callus formed as the result of treatment has not furnished a firm union. This misconception is due to the existence of the one dangerous element of such treatment. The outstanding feature of convalescence under this method is the early period at which a relative freedom is allowed. Abuse of this early freedom is a source of very real danger, and unless this possibility is kept constantly in mind disaster is sure to follow. For this reason all children must be kept in splints until ossification is well advanced. Neglect of this precaution, or failure to impress on adult patients the importance of never performing any action until it has been prescribed, would doubtless be a fertile source of re-fracture.

In the series of cases which I quote, little more than 1<sup>o</sup>/<sub>o</sub> cases of re-fracture are reported. One such was the result of a railway accident, the patient being crushed against a brick wall by some railway trucks during shunting operations —a more severe injury than that which caused the original fracture; a second occurred as the result of the patient, a young boy, being knocked off a door-step into the middle of the road by a drunken man; while a third, a case of fractured Olecranon, was due to crass stupidity and a deliberate disregard of repeated warning against resumption of work (as a painter) within a fortnight of fracture.

A fourth case of re-fracture recorded was that of a little girl of seven. Originally she had broken her Ulna, and some weeks later she returned for treatment with a complete fracture of Radius as well as fracture through the old callus of the Ulna. The last case was that of another little girl, who had sustained a green-stick fracture of both bones of the fore-arm. She had been brought up for the last time a fortnight after the accident, when her parents apparently thought she had received sufficient treatment. Abuse of early freedom led to disaster.

Two other cases suffered re-fracture whilst

still under treatment. One case, that of fracture of the surgical neck of the Humerus, was due to a fall in getting out of a bath during the third week of treatment, recovery being delayed only to a trifling extent ; in the other, union had just taken place in both fore-arm bones, when the patient met with a street accident. He was still wearing anterior and posterior splints.

It is, therefore, fair to say that massage treatment has never been *responsible* for a single case of re-fracture in over four hundred consecutive cases, as it can hardly be that any precautions would have prevented fracture in the cases where it occurred ; unless, indeed, the Olecranon had been wired. The conclusion is that return cases will be of great rarity provided the precautions mentioned elsewhere are heeded ; these being disregarded the percentage would doubtless be increased, and the impression created that the callus formed has been of poor quality and that “cases of re-fracture are not uncommon.” Professor Lucas-Championnière states that one of the most striking features in the review of his fracture cases is “the extreme rarity of the return of patients.”

The inference that mobilisation aids the formation of callus is irresistible. Further clinical evidence, however, may not be out

of place, as the truth of this statement has been in dispute for many years.

In the first place, callus is invariably formed *in excess* after fracture of a rib. It may be urged that this is due to the extreme vascularity of the bone ; but a rib is not more vascular than is a long bone at its extremities, and yet this excess is never seen in such cases as those of fracture of the surgical neck of the Humerus.

The second piece of evidence was gained as the result of a personal experience not, in its early stages, altogether happy. When the treatment of fractures first became part of my work as a house-officer, I was in constant suspense lest the fractures of the lower end of the Humerus in children should lead, as I had so often seen happen previously, to permanent impairment of function. Having resolved that movement should be applied freely, to ensure the absence of adhesions round and in the joint, I was delighted day by day to find free movement possible. But, to my disgust, about the third week the range of movement would grow less and less, the pain attending the movement correspondingly increasing ; until, by the end of the fourth week, the movements were as limited as I had previously seen them as the result of prolonged immobilisation. The limita-

tion was due to an excessive formation of callus. I am thankful to be able to add that, owing to a most protracted treatment, in two of these cases resorption took place until the children were in possession of useful, if imperfect, limbs. I trust that so it was also with a third child, whose parents left the neighbourhood before treatment was completed. During my first visit to Paris to study Professor Lucas-Championnière's methods I was able to discuss these cases with him. He showed me that the excess of callus had been due to excess of zeal, or, in other words, to an over-dose of mobilisation. Since that time I have greatly reduced the dose, the result being most satisfactory.

Finally, definite histological and pathological proof of the value of movement on the formation of callus has been provided by MM. Cornil and Coudray, who investigated the subject experimentally in animals. Professor Lucas-Championnière has summarised their conclusions as follows :—

- (1) Movements given to prevent the formation of callus failed, and led to increased formation :
- (2) If immobilisation was practised, union took place more slowly :
- (3) To prevent union it was necessary to submit the fragments to an angular movement

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to such an extent that the fragments lost contact :

(4) Operations on young animals caused a growth of callus so excessive as to resemble a tumour round the site of fracture.

Again, M. Cany has reported the results of various experiments on dogs in the “Journal de Médecine et de Chirurgie pratiques.” He concludes that, in dogs, certain fractures should not be treated by apparatus ; and, if so treated, the animal becomes “infirm.” If, on the other hand, a certain amount of movement is allowed, recovery is good provided there is no excess. “If a dog is shut up in a close space,” he says, “where it is unable to exert itself, recovery is rapid ; if it is free to do so, or is made to run about prematurely, consolidation only takes place under unfavourable circumstances, and it may be said that the animal does not recover from the fracture.”

The value of mobilisation in the treatment of fractures being thus firmly established, theoretical argument being fully supported by clinical and experimental evidence, we are in a position to answer a question most commonly put by critics, viz., “How does it come about that mobilisation is beneficial when combined with massage ; while, when combined with

external splintage, it is a fertile source of non-union?"

Let us consider the clinical facts. Non-union is, according to the usual teaching, the necessary result of mobility; and, no doubt, does often follow in those cases of fracture where mobility is combined with external splintage. When combined with massage this catastrophe is never experienced, except in such cases as those in which some extraneous structure is interposed between the fragments. Personally I have only encountered one case of delayed union, this being the case of a man who had fractured his Tibia, a piece of the Tibialis Anticus muscle being caught between the fragments.

The site of fracture which is usually quoted as being most conducive to non-union is the middle of the shaft of the Humerus. Among fourteen such fractures, and a total of over fifty fractures of the Humerus treated by massage, there has been no single instance in which there was the least reason to suppose that this accident was impending, not even when crepitus was noted as late as the twelfth day during the daily dose of mobilisation. It is clear, therefore, that other factors must be taken into account before assigning mobility as the sole cause of non-union.

We have already seen that fracture is followed by circulatory disturbance, and that this can be remedied by massage; while external splintage not only does nothing to remedy the condition but rather tends to aggravate it. Here we have the explanation of the fact that mobility produces different results in a limb treated by massage and in one that is confined in splints; but we have yet to explain why it should aid union in the one and prevent it in the other. The reason is to be found in the movement which takes place under conditions which vary according as massage has or has not been administered.

Let us consider what is taking place soon after fracture. Granulation tissue, the precursor of true callus, is formed quickly in a limb whose circulation has been restored by massage, slowly where the circulation is deficient. Mobilisation breaks down these fine granulations, whereby is set up a certain amount of local irritation which, when the circulation is good, gives rise to local hyperæmia. This, in turn, causes increased formation of granulation tissue, more rapid in its growth and more difficult to break down when the next dose of mobilisation is administered. The process continues until at length only a part of the ever increasing

granulations is broken by the movements, when true union may be said to have taken place. Thus far union may be considered as complete a fortnight or more before any evidence of union is discernible by means of the X-rays. From this time onwards mobilisation ceases to play any part in the process of repair of the bone, except in so far as it assists the massage in restoring the circulation and the vitality of the limb. It is obvious that when force is used the granulations will be broken down daily for a longer period than if the movements are performed with the care and gentleness advocated in these pages. The result is that more and more granulation tissue is laid down, and this, being subsequently transformed into callus, is the origin of excessive callus-formation. It is for this reason that the ordinary methods of massage are discredited in the treatment of fractures, as entailing too great an amount of movement between the fragments during the actual process of the massage.

Turning now to the limb in splints, we find that the circulation is deficient, and the granulations formed are, as a result, few in number and poor in quality. These are broken by some movement, and local irritation doubtless follows.

But, owing to the disorganised condition of the circulation, the ensuing hyperæmia is deficient. The stimulus needed for the increased formation of granulation tissue is present, but, in the absence of the wherewithal to effect it, the replacement of the broken granulations is so slow as not to out-pace the destruction, and non-union results. The non-union, therefore, is not due to mobility alone, as is usually believed, but to mobility in the presence of deficient circulation. This theory receives support clinically from the fact that fractures in children unite quite readily when external splintage is used, in spite of the fact that it is far more difficult to enforce immobility in a child than in an adult. But in children the disturbance of circulation due to fracture is mild and transitory, and therefore the stimulation of movement is followed by hyperæmia which leads ultimately to a free formation of callus.

This explanation is purely speculative, yet it seems to account for the clinical phenomena with a completeness which merits some attention. If the argument is sound, the doctrine of immobilisation is unsound, and the present routine treatment of many fractures stands in need of revision.

## CHAPTER IV

### HISTOLOGICAL EVIDENCE OF THE BENEFITS OF MASSAGE

BRIEF reference only is necessary to the histological changes produced by massage, and it will suffice to quote part of Professor Lucas-Championnière's extract from a paper by M. Castex entitled "Etude clinique et expérimentale sur le massage," published in the "Archives générales de Médecine," in 1891. Reference to other portions of the original paper will be found elsewhere. The histological portion of the work was prepared by MM. Toupet and Ch. Remy.

M. Castex selected a number of large dogs, whose limbs were submitted to severe injury by crushing. Some were treated by massage, the others received no treatment. About six months after injury they were killed, and the injured parts examined microscopically.

The Professor sums up the appearance seen in the non-massaged muscle (see Fig. 1) as follows :—



FIG. 1.1—Section of Muscle about six months after severe injury. The bundles of muscular fibres are separated by thick masses of white fibrous tissue.



FIG. 2.—Section similar to that shown in Fig. 1, the injured part in this case having been treated by massage. The white fibrous tissue separating the bundles of muscle fibres is normal in quantity.

<sup>1</sup> The first four figures are reproduced, by kind permission, from Prof. Lucas-Championnière's book "Traitement des fractures par le massage et la mobilisation."

(1) Dissociation into fibrillæ of the muscular fibres, as shown by well marked longitudinal striation.

(2) A hyperplasia, sometimes a simple thickening, of the connective tissue.

(3) An increase, in places, of the number of nuclei in the connective tissue.

(4) Interstitial hæmorrhages.

(5) An engorgement of blood-vessels, with a hyperplasia of their adventitious coats.

(6) The sarcolemma was usually intact, but, in one section, a multiplication of nuclei was seen, giving an appearance somewhat resembling an interstitial myositis.

The appearance of the muscles in the massaged limbs was found to be as follows (see Fig. 2) :—

(1) The muscle appeared normal.

(2) No secondary fibrous bands separated the muscle fibres.

(3) There was no fibrous thickening around the vessels.

(4) The general bulk of the muscle was greater.

(5) There were no signs of hæmorrhages.

The condition found in the walls of the vessels and in the nerves may be summarised

thus. In the case of the non-massaged limbs (see Fig. 3):—

(i) There was a hyperplasia of connective tissue about the vessels, particularly around

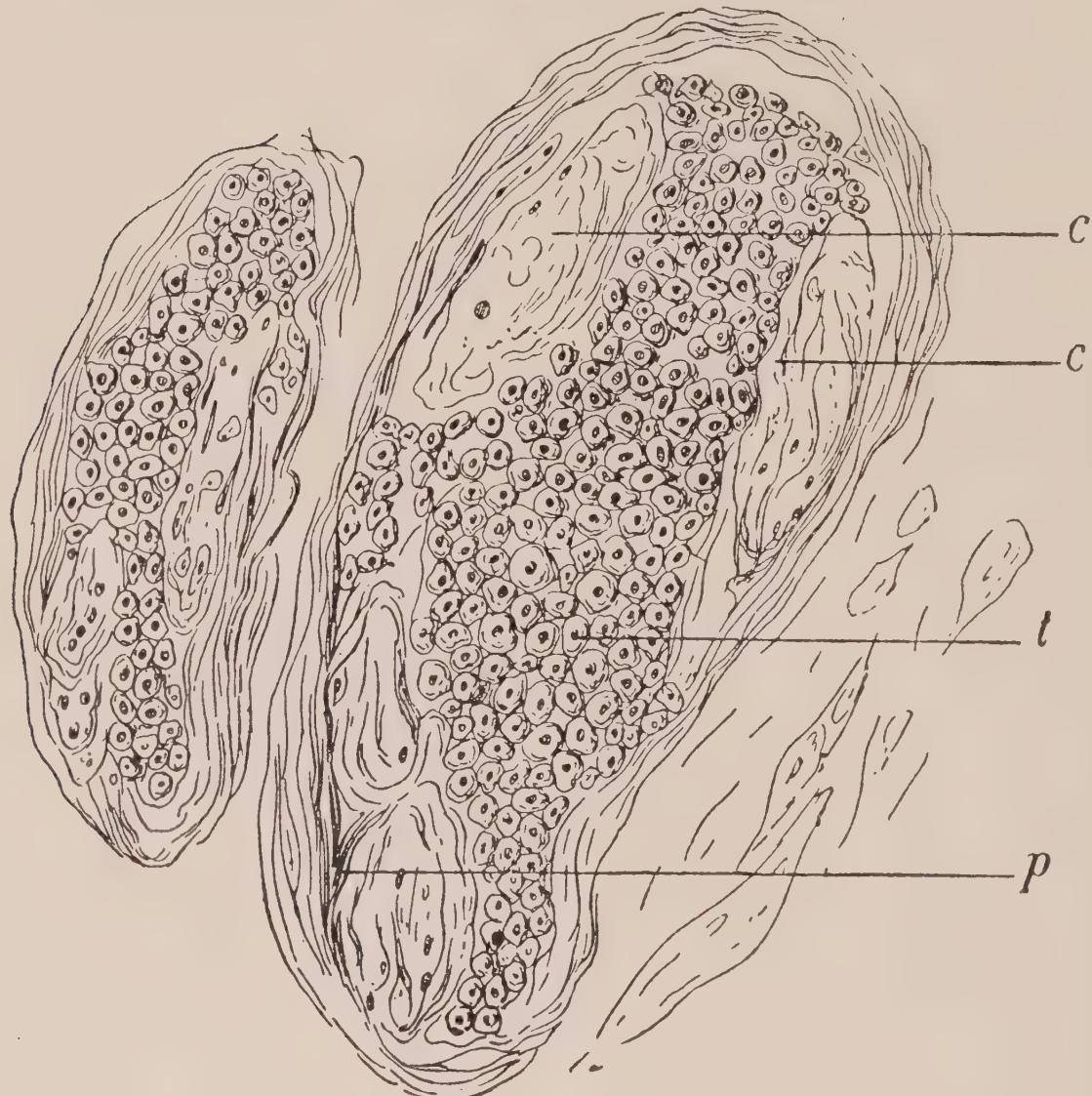


FIG. 3.—Section of Nerve about six months after severe injury.

*p.* Thickened perineurium.

*c.c.* Masses of fibrous tissue replacing nerve elements.

*t.* Shrunken axis-cylinders.

the smaller arteries, the walls of which were thickened. The overgrowth was confined to the outer coats.

(2) Within the epineurium several unstained masses were to be seen, apparently due to hyperplasia of the tissue around the minute vessels of the nerve; the epineurium

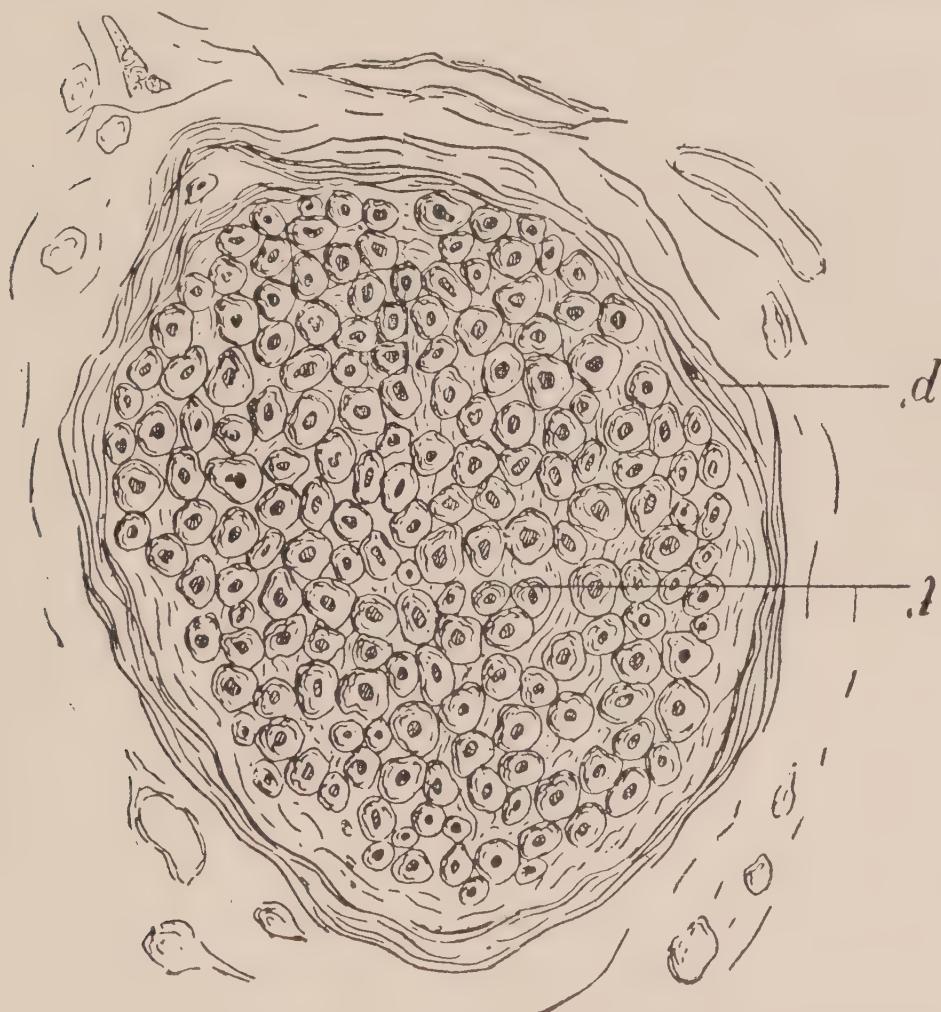


FIG. 4.—Section similar to that shown in Fig. 3, the injured part having been treated by massage.

*d.* Normal perineurium.

*t.* Normal axis-cylinders.

itself was greatly thickened, and the axis-cylinders were compressed and shrunken.

The vessels and nerves, as seen in the massaged tissues, appeared to be normal in all respects (see Fig. 4).

Unfortunately, no investigation was made as to the state of repair of fracture under the two conditions, or as to the formation of callus. It seems not unnatural to suppose that a treatment which can so improve the vitality of muscles, nerves, and vessels as to remove all trace of injury, should likewise improve the vitality of the callus-forming structures, and so aid the repair of bone. This may be the cause of the earlier ossification of callus disclosed by radiography.

However this may be, the above investigations show conclusively that in applying massage we are at least doing something to promote repair ; by the use of splints not only are we doing nothing to that end, but often, thanks to the prolonged application of splint pressure, we are doing actual harm. It is hard to conceive a method of treating fractures more pernicious than that of placing thick pads on a splint in order to exert pressure on the deformity caused by mal-position of the fragments ; or a method more disastrous than that of bandaging a limb tightly in a forced position —a method which is widely advocated for the treatment of fractures of the lower end of the Humerus, especially in children.

## CHAPTER V

### ON THE NECESSITY OF THE EXACT RESTITUTION OF THE OUTLINE OF A BONE AFTER FRACTURE

THE two salient features of the classical treatment of fractures are the necessity for strict immobilisation and exact restitution of the outline of the bones. The question of strict immobilisation has been dealt with in Chapter III., and the second "essential" now calls for consideration.

Professor Lucas-Championnière says that under the old *régime* the idea of restoring the original form of the bone inspires the whole of the most important part of treatment. Then, when the harm has been done, and functional utility has been destroyed, a lengthy treatment is commenced to restore the functions of the limb. He also points out that the great sacrifice of utility is made to an ideal which is usually unattainable.

It is only necessary to inspect a series of skiagrams of fractured limbs which have been

“set” and “put up” in splints, to realise the truth of the last statement. A true restitution of the form of a bone is a rare curiosity, and irregularity of the outline of the shadow is often the only diagnostic sign of fracture.

It may be argued that, even if the ideal reformation is unattainable, an approach may be made to it by treatment on classical lines. It is now almost universally agreed that such approach very frequently fails to approximate to the ideal with even tolerable closeness. Mr. Lane goes so far as to say that examination of radiographs has led him to the conclusion that “the displaced fragments of a bone are never, or hardly ever, restored to their normal position and that the so-called ‘setting’ of fractures is a myth.”

Experience soon teaches the truth of Dr. Hood’s statement that the fear of disturbing a relatively perfect apposition of fragments by mobilisation, in the few cases where such perfection has resulted from treatment, is “purely visionary.” Should no attempt at reduction have been found necessary, it seems clear that some form of natural internal splintage has sufficed to prevent displacement, in spite of the forces acting at the time of fracture, and afterwards as the result of muscular spasm and the weight of the limb. Such “internal splintage” may well

be afforded by an untorn periosteum, which, if of sufficient strength to withstand the forces mentioned, will also serve to maintain perfect apposition during the manipulations involved by treatment with mobilisation and massage.

When there is displacement of the fragments after fracture, the latter treatment will often produce a more perfect restitution of the form of the bone than the time-honoured treatment can effect. Indeed, as Sir William Bennett has it, "the ease with which a difficult fracture can be manipulated after it has been subjected to a gentle, smooth rubbing is a revelation to those who have had no experience in the matter."

But massage treatment enables us to go even further than this, for its effect does not cease with the reduction of the deformity: the beneficent effect remains, and the deformity, in many cases, does not recur. Thus, in cases of fracture of both bones of the forearm, when deformity has been reduced under an anæsthetic and the most rigorous splintage has been applied, it is quite a common event to discover, whether clinically or as the result of radiography, a persistent deformity. This it is frequently possible to correct painlessly by massage, and, almost as frequently, to obliterate it for good. In such cases, had treatment by immobilisation

been adhered to, deformity would often have remained undetected, as an X-ray report might have shown the position, immediately after "setting," to be satisfactory. Eventually re-fracture or operation might be necessary, with all the attendant risks, including that of non-union.

We see then that there can be no objection to the removal of splints for massage when there is free mobility of the fragments, since we do not tend to cause renewed deformity, but rather are enabled to correct any deformity which may have recurred after the application of the splints. When there is no tendency to free mobility it is obvious that no harm will follow removal of the splints.

One class of cases only must be excepted ; those, namely, in which the mobility and position of the fragments are such that any movement may tend to injure some important structure or render the fracture compound. These dangers are wont to be much over-emphasised ; and are, as a rule, imaginary, provided always that reasonable precautions are taken. The most common example of fracture occurring near an important structure is fracture of a rib. Fractured ribs are many : injured pleurae and lungs are few.

If one fragment of a broken bone presents a

sharp point immediately under the surface of the unbroken skin, it will, if let alone, cause the skin to slough. If the deformity be reduced and rigorous splintage applied, what indication is there that the deformity has failed to recur? If the fracture is treated by massage, the deformity is less likely to recur: should it do so, it will at once be noted and corrected.

The two most striking instances which I have observed of recurrence of deformity after reduction and the application of splints happened in cases of fracture of the Humerus.

The first was the case of a boy who had sustained a fracture of the surgical neck of his Humerus. The deformity had been reduced and splintage applied. I saw him two days later, when there was an obvious, sharp, angular deformity inwards at the site of fracture. This was confirmed by radiography. He was then treated by mobilisation and massage daily. On the seventh day after fracture the angle could not be discovered clinically, while five days later I was able to note that movements at the shoulder were perfect with the exception of a slight limitation of full abduction and a slight degree of rotation. Eight days after fracture he was dressed in his ordinary clothes and told to use his fore-arm and hand.

The second case was that of a shunter whose arm had been caught between the buffers of two railway-trucks as they came together ; the result being a comminuted fracture of the lower part of the Humerus. After an anæsthetic, reduction, and splintage, an X-ray photograph showed the presence of an angle at the site of fracture. The next day the arm was enormously enlarged and considerably shortened, owing to the over-lapping of the fragments. (This goes to show to some extent that the return of the deformity may be gradual.) It being one of my early cases I little anticipated the result of treatment, and therefore took no actual measurements. There was intense pain, and the œdema extended to the finger-tips. Many subcutaneous blebs had formed, one being the size of the palm of the hand, rendering treatment very difficult. After some ten minutes of massage the pain had almost disappeared, and we had the opportunity of watching a most curious phenomenon. As the posterior aspect of the limb was treated it was noticed that the spasm of the triceps was slowly wearing off, with the result that the arm was seen to lengthen posteriorly (the hand alone was supported in a sling) until it became evident that there was a marked curve with the convexity backwards. The anterior

surface was then attacked, with the result that the spasm of the muscles was relieved, while the posterior curve slowly disappeared, till, finally, the patient presented to us an obviously longer and thinner arm than when treatment commenced. This process was repeated, to a less extent, daily for three days, by which time there was at any rate no apparent shortening. An X-ray photograph taken three weeks after fracture was accompanied by the report:—“Position satisfactory, some callus beginning to ossify.” As the soft parts were in a condition which rendered operation impossible no other treatment could have brought about so satisfactory a result. By the time operation might have been performed with safety union was complete and the patient ready to begin to use his hand.

Even setting aside such cases as the above, I am able to state positively that, while mobilisation has many times played a part in bringing about a more perfect apposition of the fragments of a broken bone than had been obtained by splintage, I have never yet seen it produce or increase deformity.

As a last example of the power of massage to reduce deformity we may notice those fractures of the Olecranon in which there is

much separation of the fragments. After fracture, the upper fragment is drawn upwards and held in this position by the spasm of the Triceps. Under the influence of massage the spasm is overcome, and the fragment sinks back into apposition with the remainder of the bone. With daily application of the treatment the severity of the spasm becomes less and less until, finally, fibrous union takes place between the fragments, which are now separated only by a narrow band very little wider than that often obtained by wiring. My technique may, I know, be at fault, but there seems every prospect of obtaining yet more satisfactory results as the result of treating these fractures by massage, and I look forward confidently to the day when I shall be able to record that bony union has taken place. Professor Lucas-Championnière states that bony union is the *rule*: it is, unfortunately, not within my experience at the present, if separation of the fragments has been great (see Figs. 5, 6, 7).

The amount of bony deformity that persists after the most careful setting and splintage of a fracture is often remarkable. Herein lies a practical danger. If the splints are left in position long enough to satisfy the prejudices of the patient or his friends, the resulting

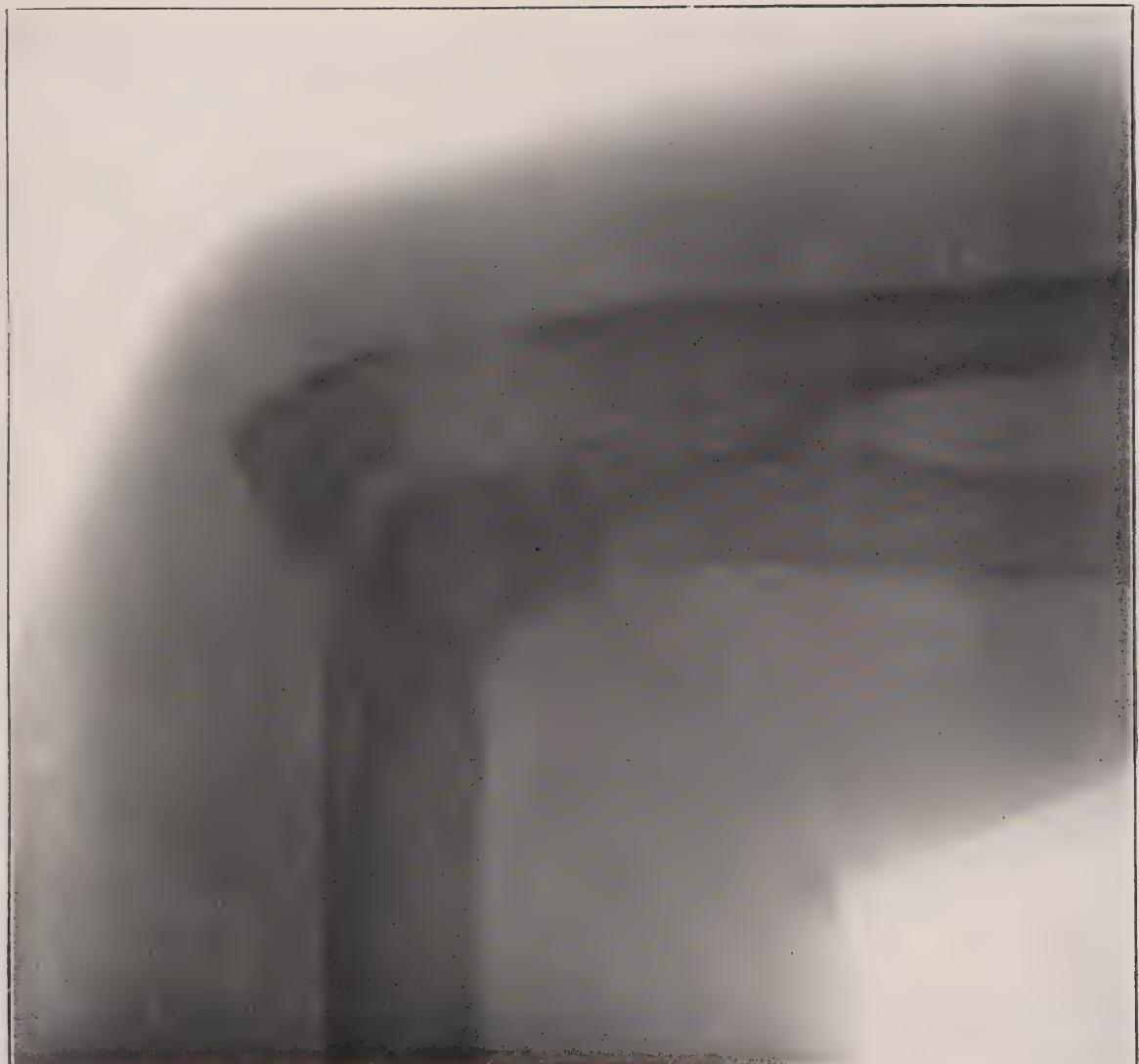


FIG. 5.

Photograph of fractured Olecranon with wide separation of fragments, taken after the first application of massage. Note the great swelling of the soft parts. The patient was a woman aged 60. She never wore a splint and was discharged at the end of four weeks with perfect movement and full strength. (*Cf.* Figs. 6 and 7.)





FIG. 6.

Same case as Fig. 5, taken about eighteen months after fracture. Clinically the separation cannot be detected, and the photographs were taken in expectation of the possibility that bony union had occurred.



deformity is attributed to the severity of the fracture. If the splints are discarded earlier, the same, or even a less marked, deformity, is liable to be regarded as the result of their premature removal. No patient has yet brought the latter accusation against me personally ; and to anticipate is, perhaps, unjustifiable.

In attempting to estimate the amount of deformity present after fracture, great care and discrimination are called for in distinguishing between actual deformity and what may be termed “pseudo-deformity.” The majority of recent fractures appear on inspection to display deformity, whether it is actually present or not, owing to the almost instantaneous onset of swelling and œdema. If deformity is in fact present, these features tend to cause its extent to be greatly exaggerated. It is impossible to over-estimate the importance of making allowance for the “pseudo-deformity” ; but not less important is it to realise how, instantaneously almost, it may make its appearance. This is more especially the case after fracture in the neighbourhood of a joint, the most favourable situation for study of the phenomenon being the region of the wrist after fracture through the lowest inch of the Radius. While the remarks that follow deal with fractures in this situation,

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it must be understood that the same apply, in varying degree, to *all* fractures.

It is probably forming a low estimate to say that 70 per cent. of persons who suffer the fracture under notice seek medical advice within the hour. Yet all such cases present deformity, and only prolonged and often specialised treatment can distinguish between simple sprain and fracture without displacement. It may be quite impossible without the use of the X-rays. The reason is that the onset of traumatic arthritis and, more particularly, of teno-synovitis, is instantaneous, and their development rapid. Even in the absence of fracture the swelling may be intense, and is sharply limited above by the two annular ligaments. It is thus that "the typical deformity of fracture" is produced. The presence of fracture without displacement does not increase the deformity, while displacement equal to half the antero-posterior thickness of the bone may magnify it but little. Most of my cases have reached me the day after fracture, immediate surgical assistance having been rendered by one of the Casualty Officers. Again and again I have seen fractures through the lowest inch of the Radius presenting apparently a hideous deformity the day after fracture and that in spite of reduction, real or imaginary, on

the previous day. Before I began my earliest experiments in the treatment by mobilisation and massage, when X-ray examination had revealed some trifling degree of deformity I frequently yielded to the desire to correct it under an anæsthetic, only to be convinced at last of the futility of the performance. Various forms of crepitus, due in part, no doubt, to bony crepitus but due also to the crepitus of the teno-synovitis and traumatic arthritis, led to the supposition that the deformity had been reduced. In no single case did X-ray examination reveal the most trivial alteration in the relative position of the fragments. And no wonder, seeing that I had only succeeded in aggravating the condition in an attempt to reduce the swelling of teno-synovitis by manipulation. Since that time I have treated some eighty fractures of this nature. Now, as before, all cases present deformity: the swelling and the deformity subside together, and I have watched many a wrist which has appeared to present gross deformity slowly assume a shape so perfect that any but close inspection might have failed to detect that fracture had been sustained. Such æsthetic perfection, however, is not usual.

We thus see how true is Professor Lucas-Championnière's statement that "surgeons often

claim for themselves the credit of having caused the disappearance of deformities, attributing it to the reduction they have practised with so much care ; whereas, in reality, it is nothing but the result of the ordinary course of events, and the resolution of the swelling alone has been the cause of the relative restoration of the shape of the limb, which occurs, in the long run, without surgical interference and often in spite of it."

The main reason why the results of treatment by immobilisation compare so unfavourably with those obtained by mobilisation and massage is that the former method aims solely at curing the bone lesion, and ignores the co-existing injuries. Cases of fracture in which the injury to bone is quite insignificant in comparison with the injury done to other structures are very common. A case in point would be a fracture through the lowest inch of the Radius with no displacement. Nothing can prevent the union of the fragments : nothing but considerable violence will cause displacement, except in those rare cases where the lower fragment has been freely mobile and has been replaced with perfect accuracy. It may be called a trivial accident, yet it is no uncommon event to find in a Physical Exercise Department cases in

which most serious results have followed the treatment of such cases by immobilisation. The reason is not far to seek. The broken bone has been treated, the traumatic arthritis and tenosynovitis have been neglected. The treatment of fractures can never be carried out successfully until it is recognised that in the very great majority of cases union will take place in the best possible position, not in spite of, but because of a regulated dose of mobilisation; and therefore that the bony injury is of very secondary importance as compared with the injury to joints, ligaments, tendons and other structures at the time of the accident, and to muscles by prolonged subsequent immobilisation. Union between the fragments of a broken bone is seldom perfect, if considered purely from the artistic standpoint, and any loss of mobility or of strength is attributed to the bony deformity, whereas it is largely due to treatment.

I have been called upon to treat two fractures through the lower third of the Humerus in which the upper third of the lower fragment could not be brought back from a position in front of the lower end of the upper fragment. The upper end of the lower fragment had, apparently, "button-holed" through the periosteum. Operation having been refused in

both cases, perfect functional utility was nevertheless restored in each case, with the exception of the last  $10^{\circ}$  of flexion. Had these cases been treated by prolonged immobilisation much greater loss of function would have resulted, and the disability would doubtless have been attributed to the vicious union, rather than to the treatment.

I have treated fractures of the lower third of the Radius presenting every degree of deformity varying from the slightest to a gross backward displacement of the lower fragment. In only one case was I unable to restore to the patient a useful, if not perfect, limb, and in that one the displacement was but slight. She was aged, feeble, "full of rheumatics" and had commencing Dupuytren's contracture of the fingers. There was more than a suspicion of a tendency to alcohol.

One point, by reason of misrepresentation, must be insisted on. While fully accepting Professor Lucas-Championnière's statement that the necessity for the restoration of the shape of a fractured bone in such cases as those of Colles' fracture is as fallacious an idea as that of the necessity for fixation, there is no excuse for treating a fracture presenting any marked degree of deformity by mobilisation and massage alone,

under the impression that the result to be attained, functional utility, justifies the neglect of deformity. There is reason to be proud of success attending the treatment of such cases as those of the two fractured Humeri mentioned above, and of the fractures through the lowest inch of the Radius with great displacement ; but only because they show how excellent may be the result of treatment under disadvantageous circumstances ; circumstances, indeed, under which many a limb has been doomed formerly to permanent impotence. Recovery in such cases will compare favourably, no doubt, with that obtained by operation if coupled with subsequent prolonged immobilisation ; but, equally there can be no doubt that results more nearly approaching perfection could be obtained by mobilisation and massage as a sequel to operation. When operative procedure is called for, it is impossible that treatment by mobilisation and massage alone can take its place with equal success : it can only hold out hope of a return of functional utility to an extent little realised by those who have no experience in the treatment by massage.

When functional utility is not restored after fracture, the failure is commonly attributed to the bony deformity which is rarely altogether

absent, and this reasoning has led to the conclusion that gross deformity necessarily jeopardises the use of a limb. A mistaken conclusion ; but, inasmuch as gross deformity is one of the signs of severity of injury, it follows that the other tissues have suffered proportionately, and to them must be applied some form of treatment.

Now, loss of function due to bony deformity is often negligible ; the loss due to treatment of severely injured muscles, tendons, and joints by splintage is considerable. The idea that gross deformity is incompatible with functional utility is a delusion ; the real cause of the loss of function in a limb presenting bony deformity being the result of treatment of severely injured soft structures and joints by immobilisation.

The conclusion, then, is that when there is slight displacement of the fragments after fracture ; or when comminution is too severe or one of the fragments too small to allow of surgical interference ; or when there is some other contra-indication to operation such as the age or condition of the patient, treatment by mobilisation and massage offers an almost certain hope of recovery with but slightly impaired function, in spite, it may be, of persistent deformity. Where there is great deformity

which resists all attempts at reduction, even under an anæsthetic combined with massage, and where contra-indications are lacking, then the best result will be obtained by operation followed by mobilisation and massage.

Mr. Arbuthnot Lane, in his "Operative treatment of fractures," appears to assign to the failure to obtain perfect apposition of the fragments credit for the many evils which so frequently follow fracture treated on classical lines. Now the claim preferred on behalf of treatment by mobilisation and massage is not that it restores perfect apposition of the fragments, but only that by its means a more perfect apposition is attained than by any other method short of open operation. If Mr. Lane's position is impregnable then the treatment advocated in these pages stands condemned.

The evidence which he adduces is so interesting that I venture on a short *résumé*.

He quotes at length alterations in the skeleton, primarily due to changes in the joints, which are the result of various kinds of labour, such as is performed by draymen, coal-trimmers, shoe-makers and other workmen of different types. These changes in the joints Mr. Lane attributes to "the habitual transmission of a force in certain specified directions over a long

period of time." The illustrations he offers suggest ordinary osteo-arthritis. Moreover many joints may be affected as the result of one occupation, as evidenced by the illustrations of several joints of a coal-trimmer.

He then considers the "changes which the skeleton undergoes in consequence of the sudden transmission of a force in excess of what it can transmit without undergoing alteration," and quotes as examples a fall on the outstretched hand causing a spreading osteo-arthritis in the joints of the elbow region, a fall on the side followed by osteo-arthritis of the hip, and the various athletic joints, such as "tennis—" and "golf-elbows." All these changes are attributed to the injury having deprived the articular cartilages of vitality.

Lastly, he considers the changes which ensue in the skeleton on the fracture of one or more bones the fragments of which have not been restored to their natural relationship. These changes, he points out, strongly resemble those of the occupation deformities, and result from similar causes, the chief being the transmission of force along unaccustomed lines.

Now I fully believe that the medical man who fails to use every means in his power to reduce to a minimum the deformity resulting

from fracture fails in his duty to his patient ; also that treatment by mobilisation and massage affords the most favourable means to that end, short of operation. But, however excellent may be the reduction effected by this treatment, it rarely attains perfection, and without perfection, if we are to accept Mr. Lane's argument, the patient is liable to all the horrors of osteoarthritis in the neighbouring joints. It is necessary, therefore, to combat his argument if the claims made for treatment by mobilisation and massage are to be made good.

No answer is to be found in the literature : I am therefore compelled to be content to set forth the result of personal reflection on the subject, strengthened by the conviction that, were the lack of perfect restoration of the outline of a bone fraught with such evils as Mr. Lane suggests, it would be impossible for Professor Lucas-Championnière to have made such statements as appeared in the *British Medical Journal* of October 3, 1908. "A certain degree of shortening," he says, "is even favourable to the repair of muscular power." Again, "after fracture, far from considering shortening as a vexatious accident, it must rather be regarded as a providential phenomenon for the restoration of function," and, "the restoration to a limb of

the greatest possible amount of suppleness, of the greatest possible muscular power, is a hundred times more important than the restoration of the exact shape of the skeleton."

As regards the actual attempt to reduce deformity he says, "Attempts to reduce a fracture ought to have in view every deviation of the axis, and all deformities injurious to the functions of the limb, without going beyond that. . . . Even impaction of the fragments should be respected to a certain extent." And, lastly, "The comparison of cases treated by mobilisation and those treated by suture is quite interesting and entirely in favour of mobilisation. . . . I put aside various disadvantages of suture . . . . (and find) repair after suture is always more tardy than after mobilisation. Let it be perfect as it may, it is still inferior in shortening the period of definite repair. . . . That is one of the reasons why I reject as inferior suture of the Clavicle and suture of the Olecranon as a method of general treatment." It is incredible that any surgeon of vast experience could inflict on his patients the evils of chronic joint disease in order to gain a "shortening in the period of definite repair"; or that he could, were such evil effects consequent on one method of treatment and not on another, have failed to remark it.

Let us start, then, with the hypothesis that any injury to a joint is liable to set up a traumatic arthritis; and that any form of irritation, if often repeated, is liable to maintain that condition when once established. The arthritis having become chronic, articular changes follow. Next come changes in the ends of the bones which may, in time, give rise to deformity of the joints. As a consequence, Mr. Lane has established beyond all doubt that structural changes take place in the bone, such as have been seen in the shaft of the Humerus of a small child who had sustained a supra-condylar fracture of the lower end of the bone with great displacement backwards; or such as follow fracture below the Trochanters of the Femur with displacement.

I am unable to discover any evidence which supports the view that "occupation arthritis" is due to the "habitual transmission of a force in certain specified directions" rather than the view that the changes are caused by a constant jarring and straining of the joints, such as must necessarily be entailed by any occupation of the kind alluded to, whereby has been set up a traumatic arthritis which is maintained by a constant repetition of the injury until chronic arthritis, with the accompanying changes in the bony

extremities, is established. If the latter explanation is correct, it becomes necessary, in order to vindicate Mr. Lane's theory, to show why the failure to restore the perfect shape of a bone should occasion any jarring or other action injurious to the joints during the normal exercise of the functions of the body ; and it is difficult to discover any reason for supposing that the grossest deformity should have this effect.

Of the changes in joints produced by tennis, golf, and so on, I have no personal experience. I am, of course, well acquainted with the "tennis-elbow" and "tennis-shoulder" which, occurring during the first few days of the season, may prohibit further participation in the game ; and also with the "golf-elbow" of the beginner, which may return as the result of a golfing holiday ; but I have been accustomed to attribute these troubles to the sudden and repeated strains placed upon the joints—by golf, at any rate, whereof the jars and wrenches are many and severe—and not, as Mr. Lane has it, to the "sudden transmission of a force in excess of what it (the skeleton) can transmit without undergoing alteration."

Turning to the well-established phenomena of joint changes in elbow or hip resulting from

severe falls, Mr. Lane considers that the trouble here arises from the fact of the blow having deprived the articular surfaces of vitality. I first encountered such cases in the Out-patient Department, and came to the conclusion that my patients attributed their complaint to a fall for lack of better explanation, much as they might have attributed an attack of general peritonitis or typhoid fever to sitting in a draught.

In the Casualty Department, however, I saw cases which led me to alter my opinion ; and I was much impressed on observing the great rapidity with which muscles showed signs of wasting as the result of certain falls, and the extent to which wasting progressed in the absence of any gross injury to account for the phenomenon. Now this wasting of the muscles is invariably in excess of what might reasonably be expected from the amount of disuse involved, and the only other causes of muscular atrophy which have come under my notice have owed their origin directly or indirectly to interference with the nervous or vascular mechanisms. The latter, in the cases under consideration, could be dismissed. We have remaining, therefore, as causes of muscular wasting following accident, direct interference with, or injury to, some

portion of the nervous system, and blows or other injury without apparent direct injury to the nervous system. Still to be accounted for is the extensive wasting of muscles seen in cases of Osteo-arthritis, as to which I was at a total loss until I read a paper by M. Castex on massage, published in the "Archives générales de Médecine," 1891. He quotes an experiment on dogs and rabbits in which the posterior nerve roots of the lowest three lumbar nerves were divided on the left side. When the wounds were healed a traumatic arthritis was set up in both knee-joints by means of the insertion of the actual cautery into the joints. Three months later the animals were killed. In all cases both knees showed marked osteo-arthritis changes, the thigh muscles were normal on the left side, atrophied on the right. All the animals had made free and apparently equal use of both legs. He concludes, therefore, that the atrophy was reflex.

Now, in the cases under notice where permanent joint trouble has followed the receipt of a single severe injury, the muscular atrophy is well established before any organic changes can be demonstrated clinically in the joints. M. Castex has shown that the wasting of muscles may be reflex; and reasons have been suggested

for thinking that the swelling and œdema seen after the injury of fracture are, in part at any rate, vaso-motor in origin and that the muscular spasm is also reflex. Is it, therefore, unreasonable to suppose that the muscular wasting seen in the cases in point is reflex likewise? If not, the possibility that the joint changes are also reflex in origin becomes a probability.

There is no need to enter into the discussion which has raged round the origin of Osteo-arthritis. It matters nothing to the argument whether the disease is due to direct trophic changes or whether owing to the lowered vitality of the joint due to interference with its trophic nervous mechanism, some specific organism has been allowed to flourish. This result of much deliberation on the subject is submitted for two reasons; first, because Mr. Lane makes Osteo-arthritis serve as a strong argument for the exact restoration of the form of a bone after fracture—a necessity which is not admitted—and secondly because, if the theory propounded is correct, there seems to be an additional reason for urging the desirability of massage in cases of fracture when there is reason to suppose that a joint has sustained simultaneous injury; the reason, namely, that the massage, acting reflexly through the nervous

system, may counteract the evil effects of the reflex originated by the injury. That such effects are possible is shown by the fact that massage may check or even prevent the origin of muscular atrophy as the sequel to traumatism.

Lastly, Mr. Lane deals with the changes in joints seen after fracture where restoration of the shape of the bone has lacked perfection, comparing these changes to those seen in "occupation joints." I have been at some pains to examine museum specimens of a large number of examples of vicious union. A small proportion only show signs of arthritic trouble, and those, in the main, are cases of fracture where severe simultaneous injury must have been inflicted on the joints, giving us a practical demonstration against the treatment of traumatic arthritis by immobilisation even if accompanied by fracture.

He also quotes various structural changes in the bones, such as that which follows in the head and neck of the Femur after fracture below the lesser Trochanter. Of this he says, "It is in consequence of the development of these arthritic changes"—he refers to the bony relations of the joint, the cartilages appearing to be healthy—"that the pain and disability which so often

follow on fractures are due." Why such changes should be supposed to cause pain does not appear ; but we know that the wasting and matting together of muscles and the formation of dense cicatricial tissue as the result of immobilisation give rise to great pain and permanent disability. Were these obviated by the use of massage and mobilisation, the structural changes in the bone, the natural adaptation to altered circumstances, should cause no discomfort. Dr. Dagron was kind enough to show me a young woman who had sustained a fracture near the Trochanters. There was great comminution and some two inches of shortening. The bony injury was considered to be too severe for the question of operation to be considered. She had been treated by mobilisation and massage throughout and treatment had terminated a considerable time previously. No doubt structural changes were taking place in her Femur : she was in total ignorance of the fact, as she possessed perfect movement ; and she suffered no pain.

Moreover, fracture is frequently caused with all deliberation in the operation of sub-trochanteric osteotomy. No mention is made beforehand of any desirability of warning patients or their friends of the danger of sub-

sequent osteo-arthritis in the joints as the result of alteration in the lines of force: did such danger exist many of these operations, and, in fact, most osteotomy operations, would ultimately give rise to a condition more disabling than that which they are intended to cure. But during these operations there is a minimum of injury done to the soft parts, and there is complete absence of traumatism to neighbouring joints, though structural changes in the bones must perforce be universal since these operations are performed, at least as a general rule, before the bones are too old to accommodate themselves to altered circumstances. Yet the changes are painless, there is no disability, and, since surgeons regard these operations as expedient, it is hard to believe that arthritis follows as a necessary sequence. Why then should ordinary simple fracture be followed by pain, arthritis, and disability, while artificial fracture by operation lacks these sequelæ? The answer is obvious. The injury inflicted on the soft parts during operation is slight, but is often great as the result of fracture: hence the absence after operation of cicatricial tissue and adhesions which are the cause of pain after fracture. If there is no injury to the soft parts after fracture there is no subsequent pain or disability, apart

from arthritic changes originating in a concomitant traumatic arthritis. The latter being absent in osteotomy cases, subsequent arthritis is also absent. Such at any rate seems to be the explanation : if it is fallacious, then assuredly many osteotomies are unjustifiable.

But this argument cannot explain the vast improvement in the results which follow operative as opposed to classical treatment of fractures. How then is that improvement to be explained ? It appears that operative interference should be regarded only as a stage in treatment by mobilisation and massage. Prolonged immobilisation, which *alone* is answerable for well-nigh all the disastrous sequelæ of fractures, forms no part of operative treatment ; if it did, many of the evils which follow classical treatment would persist in spite of restitution of the exact form of the skeleton, however perfect. The true secret of the success attending operative interference lies in the early recourse to mobilisation with or without massage, and the sooner this stage of treatment is reached the greater will be the success. Beyond the risks attendant on faulty technique, operative measures are sure to be crowned with greater success than the time-honoured methods, but only if combined with early mobilisation : where there is gross

deformity, excessive mobility, or danger of injury to soft parts, operation as a first stage may at times be attended with greater success than treatment by mobilisation and massage alone ; while in another and much larger class of fractures either it is unnecessary to secure a perfect restoration of the position of fragments at all, or else as perfect restoration is obtainable by mobilisation and massage as by operation. These cases can gain nothing from operation, but rather suffer, it may be heavily, by reason of the "necessary" delay in commencing massage and movements during the healing of the wound.

In sum :

- (i) It is the duty of a medical man to restore, as far as he is able, the fragments of a fractured bone to their original position ;
- (ii) The most efficient means at his disposal, short of open operation, lie in the use of mobilisation and massage ;
- (iii) The long axes of the fragments must remain parallel ;
- (iv) The attainment of perfect reduction, short of open operation, is rare, but no pernicious

<sup>1</sup> An example of the reduction of deformity by mobilisation and massage is illustrated in Figs. 26 and 27, page 186A.

effects are to be feared as the result of failure to attain perfection ;

(v) Complete restoration of function should be the criterion of treatment and not perfect structural restoration ;

(vi) Operation should be advised whenever :—

(a) Gross deformity persists,

(b) Any deformity interferes with the function of the limb,

(c) There is persistent deviation of axis,

(d) Shortening—in spite of perfect use—is disadvantageous to the patient.

The value of operation in the four cases (vi) is inestimable, but the number of instances decreases in inverse ratio with the skill guiding the manipulations of the practitioner of mobilisation and massage.

Such is my belief, and such is the teaching of Professor Lucas-Championnière as I have understood and endeavoured to practise it. It may be thought that to advocate operation at all is to oppose the doctrine of the Professor. But that is to do him and his treatment as great an injustice, perhaps, as any they suffer under to-day. By way of disposing of such an idea, I may say that he showed me two cases of

fracture of the leg for which he had performed operation ; also that it is not unusual to hear him boast that at the present time no surgeon has sutured a greater number of Patellæ than himself.

## CHAPTER VI

### CLINICAL RESULTS OBTAINED BY TREATMENT

#### I. IMMEDIATE

THE first clinical effect of massage in cases of recent fracture is, as has been said, the relief of pain. Too much stress cannot be laid on the fact that to secure this result the ordinary methods of massage are far too vigorous ; all we can allow is a stroking of the injured part slowly and lightly, always in the same direction, following the direction of the venous flow or the fibres of the underlying muscles. This movement must be repeated with mechanical regularity and the utmost patience, or the relief of pain is not possible.

It is a curious fact that any alteration, however slight, in the direction of the movements will, if the fracture is recent, cause immediate return of the spasm and pain, even though these have been completely removed by correct massage.

Dr. Wharton Hood attributes the relief of pain as the result of massage to the unloading of the vessels of the limb; which, by reducing the swelling, reduces the pressure on the nerve endings. He says we must regard the swollen portion of the limb in the light of a sponge full of fluid, which is gradually emptied by pressure on the proximal portion of the limb directed centrally; the result of thus commencing at the periphery being "roughly likened to the removal of a cork as the preliminary to emptying a bottle." But it is incredible that this explanation of the effect of massage on mechanical grounds should suffice to explain the clinical facts. Otherwise it follows that the heavier the massage the more rapid will be the "emptying"; a most pernicious doctrine and one that would justify the use of the heaviest forms of massage in cases of recent injury, including those of fracture. The reverse, however, is the case, the lighter the massage the more profound will be the result.

It is at once obvious that a massage so gentle as to be described by Professor Lucas-Championnière "as almost resembling mesmeric passes" could not cause relief before a dozen such "passes" have been made if the action of the massage were merely mechanical. So light

is the touch required that the tiny veins of the skin are scarcely blanched ; yet it is sufficient at once to please the patient, and soon quite to relieve him. It is true that the œdema may be softer at the end of treatment, but it is not gone : if the massage is administered immediately after fracture the result is the same as regards the relief of pain, but it will not prevent subsequent swelling though doing much to render it less severe.

Without in the least degree attributing to massage the electrical properties which MM. Chazaram and Décle have stated it to possess, Professor Lucas-Championnière is justified in claiming for this treatment results more profound than many observers have been willing to recognise.

It has recently been my lot to treat a patient for neurasthenia of a most intractable kind. For eight months he had been suffering from insomnia, during which time he had twice undergone so-called "rest cures" in London nursing homes. On each occasion "massage" had formed the most important part of treatment. It was only after the lapse of some days that I was able to convince myself of the patient's sanity. I treated him with massage—the glucokinesis—with the result that he was

sleeping fairly well at the end of a week : at the end of a fortnight he was sleeping well and was able to take an intelligent interest in human affairs ; while by the end of the third week he was sleeping six or seven hours a night. At this point drug treatment was added, and therefore it is impossible to attribute all the future progress to the massage, which was only continued for another week. Suffice it to say that improvement has been steadily maintained, and that he is now at work in a responsible position in a big London office. It is about six months since I last saw this patient.

No mechanical effect could be supposed to account for this result ; on the contrary, when those whose treatment was calculated to produce results mechanically had tried and failed, on an attempt being made to secure an action through the nervous system improvement began forthwith.

We know nothing of the therapeutic action of massage : we only know its results, and that imperfectly, owing to the great abuse the treatment has undergone at the hands of many of its recognised exponents. The abuse arises from ignorance of the reflex action, coupled with the idea that massage owes its usefulness to mechanical processes. This, as already seen, is

inaccurate ; and I offer the only alternative explanation, viz., nerve-reflex. Professor Lucas-Championnière endorses this opinion. "Massage," he says, "certainly gives rise to some action on the nerves, an action which is rapid, almost instantaneous, and contributes strongly to the phenomena of repair. . . . If, as I have shown, the action on nutrition by excitation of the nervous system be admitted, much of that which remains mysterious in the action of massage is, in a certain measure, explained. . . . Not least among the consequences of the introduction of massage into the treatment of fractures will be the introduction into the theory of massage of elements which will allow the phenomena, the marked transformations in nutrition effected by massage, to be appreciated at their real value." With the coming of that appreciation it is to be hoped that the methods of massage as at present practised, rarely scientific, sometimes dangerous, often futile, will go ; to be replaced by a "massage" worthy of medical science and deserving the confidence of the profession.

Three things are certain : first, that the pain experienced after fracture is mainly due to muscular spasm ; secondly, that massage does not itself give entire relief from pain but simply

soothes until the spasm is completely relaxed ; thirdly, that spasm is nearly always present when there is pain. A certain amount of pain is due no doubt to injury to the soft parts, but this is negligible except in those cases where a nerve has suffered direct injury, as, for instance, after fracture of the Olecranon. I have only seen one painless fracture, a complete fracture of Tibia and Fibula in a tabetic patient ; this being likewise the only case I have seen of recent fracture with which there was no muscular spasm. So advanced was the disease in this case that there was no attempt at union, and the patient died shortly afterwards. He was admitted to the wards immediately after fracture.

Thanks to the teaching generally in vogue that crepitus is an infallible sign of fracture, all patients who have suffered this catastrophe are subjected to excruciating torture in the attempt to confirm or establish diagnosis by this means. The crepitus itself seems to cause intense pain. And yet, when the pain has first been relieved by massage, it is quite usual to feel crepitus between the fragments and to be told quietly by the patient that he felt the bone "click." This sensation is reported with no complaint that pain has accompanied the "clicking," but merely as an event of curious and unusual

interest ; partly also, perhaps, in order to confirm the diagnosis. Should the range of movement between the fragments have been sufficient to entail the "nipping" of the sensitive periosteum, the pain is sharp, and is accompanied by an intense reflex spasm of the muscles.

These observations indicate that the bone surfaces are insensitive ; and that when muscular spasm has been relieved the only cause of pain during their movement is due to the nipping or jarring of the sensitive periosteum, which in turn causes a reflex spasm of muscle.

Certain it is, at any rate, that the second great result of massage is the relief of muscular spasm, relief which can only be attributed to reflex action. And this is not surprising, and calls for less explanation than the other phenomena ascribed to nerve reflex. We know that muscular contraction succeeds many forms of external stimulation, as evidenced by the abdominal, cremasteric and planter reflexes. If one form of cutaneous stimulation can produce a reflex spasm of muscle, it can readily be imagined that another form may be able to cause a reflex relaxation of muscles already in spasm. If it is once admitted that cutaneous massage is capable of relieving muscular spasm after

fracture, as is bountifully attested by various writers, we are forced to admit that massage is capable of exciting one reflex ; and this lends colour to the arguments already adduced to show that various other effects of massage, which otherwise remain unexplained, are also manifestations of reflex action.

In addition to the relief of pain another immediate, and curious, result of the cessation of muscular spasm may be noticed. Patients, as the pain and spasm pass off, usually essay some voluntary movement. To instance a very common event : a fore-arm is taken out of splints the day after fracture has been sustained through the lowest inch of the Radius. It is found to be a swollen and apparently useless member. In a few minutes it is still swollen but no longer lifeless. First one finger is tentatively moved, then another, till finally the majority of movements possible in fingers and wrist are indulged in to a greater or less extent, to the natural joy and relief of the patient.

These early, though feeble, attempts at voluntary movement constitute the third immediate result of massage as observed clinically. The restored power of movement being the direct result of the relief of muscular spasm, it follows that massage must be continued until the

spasm completely disappears, which event will be found to coincide with the complete relief of pain. Hence the statement that the relief of pain indicates at once that the massage has been efficiently performed and that the second part of treatment, mobilisation, may be commenced.

To sum up : mobilisation while the muscular spasm persists is impossible, any movements performed partaking of the nature of forced movements, which are entirely reprehensible. The spasm disappears simultaneously with the relief of pain.

## CHAPTER VII

### CLINICAL RESULTS OBTAINED BY TREATMENT II. SECONDARY

THE disappearance of the swelling, as one of the results of massage, has already been noticed. Mention may, however, be made of a recent case of fracture of the Clavicle where the swelling extended to the finger-tips on the fourth day, when I first saw the patient, while some four days later the report was made that swelling had entirely disappeared from the limb, remaining only over a bruised portion of the Trapezius.

However intense the swelling, it may be expected to disappear almost entirely in the course of a week. Exception must be made of cases where there has been direct injury to the soft tissues, as in the case I have mentioned of the man whose arm was caught between the buffers of two railway trucks ; also of cases of multiple fractures in the same limb, and of cases where massage has not been practised for several days,

the treatment meanwhile being confined to immobilisation.

One objection raised against the treatment of fractures by massage and mobilisation is that the œdema produced is frequently intense. As to this, it may be asserted with confidence that the earlier massage is commenced, provided that the massage consists solely of the process described under the heading of "glucokinesis," the more quickly will the œdema vanish ; that cases treated immediately after fracture by massage never show any sign of this increased swelling, but rather the reverse ; and that cases in which treatment has been much delayed often present an intense œdema which disappears only as the result of prolonged treatment.

A feature of massage-treatment which affords a never-failing source of wonder to patients is the rapidity with which the "bruise comes out." It is not unusual to find bruises which were of the slightest on the first day with a great area of discolouration on the second. I was once accused of having caused such a change ! It is difficult to estimate the rapidity of development and disappearance in the absence of definite records ; but, roughly speaking, it may be said that the discolouration is at its height by the third day and disappears far more rapidly than do bruises treated

by other methods. Professor Lucas-Championnière endorses this statement. The discolouration is often not a "bruise" strictly speaking.

A point of greater practical importance is the condition of the skin itself. The skin of a limb that has long been immobilised always has a particularly dead appearance, with free exfoliation. It is rough, and its elasticity is diminished. When massage has been employed this condition is unknown. The skin remains quite supple, there is no shedding of the epithelium, and sensation continues unimpaired. Moreover, it is quite unusual for a patient to complain of cold or numbness in the injured limb ; while it is not unusual to hear that a limb which has been submitted to immobilisation feels "cold and dead," while the condition often much resembles that seen after prolonged suppuration. The adherence of the skin to the deeper structures is often marked, and prolonged treatment is needed to restore its mobility and suppleness.

The action of massage on the deeper structures is more valuable still, its power to maintain the vitality of muscles being well recognised. I have had occasion to massage a leg for ununited fracture, caused by a piece of the Tibialis Anticus muscle being caught between the frag-

ments of the broken Tibia, for a period of some four months. Such exercises as were possible also formed a part of treatment. During this time there was no sign whatever of muscular wasting in the leg or thigh, no adhesions were formed, and directly union was sufficiently strong to carry his weight the patient was able to walk. He suffered no inconvenience from swelling or cœdema. I do not mean to advance this case as a vindication of treatment by mobilisation and massage alone. I have it on record that on two occasions treatment was interrupted in order to press forward the claim of operative interference ; though this by no means represents the limit of my endeavours to secure for the patient what was undoubtedly the correct method of treatment. It is only quoted to show two points. First, that the patient was able to use his limb in an ordinary way as soon as union was sufficiently strong to support his weight, in spite of the fact that fifteen weeks had elapsed during which he was unable to put foot to the ground ; and, second, that treatment by mobilisation and massage offers a distinct hope of a comparatively speedy and complete recovery in cases where operation, although undoubtedly the correct and obvious treatment, is, for one reason or another, withheld. In the case under

consideration, I overlooked the necessity for treating the gluteal region. The contrast between the muscles in this situation and those in the thigh and leg was very great. Although apparently not interfering with the man's work, the wasting of the *Gluteus maximus* was so great that I doubt whether the buttock will ever resume its former contour.

The usual explanation of the fact that massage is able to maintain the vitality of muscles is that the mechanical pressure exerted on the muscular fibres has the same effect on the circulation as would have the actual contraction of the muscles. This can be only a partial explanation, and it will once more be seen that the action of the massage is more profound. M. Mervy is said by Professor Lucas-Championnière to have shown that when, during the most superficial massage—"almost mesmeric passes," the tips of the fingers approach certain points, muscular contraction can be seen to take place. For some time I regarded this as a fable, but closer observation showed my mistake. What I had looked to find was a general contraction of the whole muscle; whereas what may often be observed, though more often there is no sign of it, is a very gentle contraction of a small portion of

the muscle. The most favourable positions for witnessing this action of massage is in those regions of the body where the muscular fibres are coarse: where they are finer the contractions do no doubt take place, but the contracting bundles are so small that the movement is not noticeable on the surface. The three muscles in which this contraction may best be studied are the Deltoid, the Pectoralis Major and the Vastus Externus. The contractions are better marked if the muscles are slightly wasted. I have every reason to suppose that the contractions take place as the fingers pass over the so-called "motor-points," but the field of observation is at present too limited to enable one to speak confidently.

There remain to be considered the effects of treatment on the joints, which result mainly from mobilisation.

It is true that immobilisation of a joint, except in a few cases of disease, never leads to bony ankylosis; but the latter condition is not the only cause of loss of function or of permanent weakness. Adhesions may form in the peri-articular tissues of sufficient strength to render movement of a joint difficult, even under an anæsthetic; while a slender adhesion may occasion lasting trouble as the result of some

slight tension placed upon it by movement. The tension causes pain, to check which there is an involuntary contraction of the muscles, and the patient describes the joint as being "weak." Without proper treatment to effect the "breaking down" of such adhesion this "weakness" of the joint continues indefinitely, the muscles acting upon it thus becoming feeble and wasted, and there is permanent loss of strength in the limb.

When strict immobilisation is applied to a limb after fracture, this cause of "weakness" acts the more readily on muscles which are already wasted as the result of disuse, and accounts very largely for the tedious convalescence. Moreover, as Sir William Bennett pointed out in *The Lancet* as long ago as 1898, in addition to temporary discomfort, pain, and stiffness, many real dangers are encountered as the result of adhesions forming after fracture when the limb is immobilised.

Sir William quotes a case in which both bones of the leg had been broken three inches above the ankle some two months previous to operation. Union was firm, position fair. "No movement beyond a little 'springing' in the ankle-joint could be produced by violence such as is ordinarily used in the 'breaking-down' of joints.

The ankle was healthy and the stiffness was entirely due to the state of the soft parts around the fracture." The muscles in front of and behind the bones at the site of fracture were matted to each other and to the bones by cicatricial tissue in which the posterior tibial nerve was involved ; though "the nerve showed no sign of having been damaged at the time of the accident." The writer goes on to observe that "the implication of the posterior tibial nerve is interesting, as it affords a ready explanation of the acute nerve pain caused by attempts at movement of the ankle-joint in walking after some cases of fracture in the lower part of the leg. In the treatment of cases of recent fracture by massage and movements, this matting of the soft parts is impossible."

Although it must be very unusual to encounter such severe symptoms as those quoted as a sequel to treatment by immobilisation, yet the number of cases in which obscure pains and loss of function are to be noted in the absence of all apparent cause is remarkable. Doubtless the origin lies in the implication of various structures in cicatricial tissue.

In the series of cases quoted where the treatment has been confined to mobilisation and massage, there was never in one instance reason

to suppose that adhesions had formed ; while a condition which might suggest the desirability of "breaking-down" a joint was equally unknown. In fact, my experience simply exemplifies the statement made by Sir William Bennett later in the same article, and I cannot do better than summarise that experience by using his words. "If a fracture is treated by mobilisation and massage, the tendons are prevented from becoming adherent, the muscles do not waste, the joints are kept supple and the nerves cannot become implicated in adhesions. It therefore follows that, upon the patient resuming the use of the damaged limb, the joints are as freely movable as if no fracture had occurred, the muscles are well developed and comparatively strong, and the neuralgic pain so often met with under ordinary circumstances is wanting. Indeed, with the exception of shortening or deformity, which may be the immediate outcome of fracture, the limb is, in ordinary uncomplicated cases, as sound and healthy as that of the opposite side."

Compare this with what the same author expresses as his opinion of the treatment on classical lines. "In any event," he says, "whatever treatment is adopted for the rectification of stiffness due to adhesions resulting from long-continued fixation, the disability of

the patient is prolonged beyond all reasonable limit, and, in some cases, becomes permanent.”<sup>1</sup> So great is the postponement of recovery as the result of prolonged fixation that, as he says in another place, “the result of the (massage) method is undoubtedly advantageous, inasmuch as the time elapsing before the patient is able to resume his ordinary avocation is diminished by at least one-third”;<sup>2</sup> and, “ultimately the time which is occupied in the complete recovery of the patient is little more than half of that which follows the treatment by splints in the ordinary manner.”<sup>3</sup>

Statements such as these, which are in fact fully justified and in no way exaggerated, are liable to be greeted with scepticism in the absence of definite clinical proof. I am fortunate to be able to contrast two cases from personal experience which supply that proof in a manner that is sufficiently convincing.

One day an acrobat arrived at Hospital who had sustained a fracture through the middle of the shaft of the Humerus about three weeks previously. There had been some comminution and the limb had been placed in a plaster splint at once. On removing the plaster the fingers

<sup>1</sup> *Massage in Recent Fractures, &c.*, p. 5.

<sup>2</sup> *Ibid.* p. 11.

<sup>3</sup> *Ibid.* p. 30.

were found to be stiff and almost powerless, the wrist and elbow quite rigid, and the shoulder was very sensitive on attempts being made to move it. He was placed under gas and the joints were "broken down." Then commenced a long and tedious course of treatment to restore to the patient the use of his arm.

Some ten days later a young goods-porter from the South Western Railway was brought in with an almost identical fracture: there was, however, no comminution though this was more than compensated for by the fact that there was such free mobility of the fragments that the outer portion of the triceps had been torn right through to the skin, and a wide separation of the muscular fibres could be felt. When I first saw the case, the fragments presented a sharp angle forwards (in spite of careful "setting" and splintage the previous day), it being reported, as the result of X-ray examination, that the fragments were in satisfactory position. At the end of three weeks he was sent to the Physical Exercise Department with the fragments in excellent position, with almost perfect movement and fair strength. Twelve days later he returned to full work at Nine Elms, having already done "light work" there for three days.

Of these two patients, therefore, the one who received treatment by mobilisation and massage throughout returned with full restoration of function to work of the most laborious nature six weeks after the date of fracture. The other, who had been treated by immobilisation for three weeks, after the same lapse of time, had movement at the elbow from  $140^{\circ}$ — $88^{\circ}$ , the deltoid was "very wasted" and there was a far greater thickening around the site of fracture. A fortnight later all that could be reported was that function was improving, with a special note to the effect that there was some weakness of the metacarpo-phalangeal joint and slight weakness of the wrist. After another week of treatment he went abroad again. I cannot say how soon he was able to resume his work : he would certainly have been useless at Nine Elms in the condition that existed when he last presented himself at Hospital, in spite of having received "active" treatment for practically the same length of time as the other patient, disregarding the three weeks spent in plaster.

It is claimed that immobilisation relieves the pain of fracture. It does so : but the pain is never relieved in a few moments as by massage ; and, after the spell of immobilisation, the patient has to undergo a vast deal of

pain which is unknown after treatment by mobilisation. Thus, returning to the two cases just cited, the man who was treated by massage from the second day made an almost painless recovery ; his sufferings during the first night, spent in splints without massage, were no doubt as severe as those of his fellow-patient ; but from that point onwards he suffered less and there was no return of pain. The other poor wretch suffered agony, intense and prolonged, as the result of the manipulations under gas, which were renewed in part day by day, for weeks, during the process of the forced movements which were employed to restore the use of his limb.

## CHAPTER VIII

### THE TREATMENT OF COMPOUND FRACTURES

IN the previous chapters the term “fracture” has been intended to signify “simple fracture.” All that has been said so far is the outcome of observations made in an Out-patient Department, where alone I have had the opportunity of treating my cases, supplemented by references to the work of various authors. In an Out-patient Department a compound fracture cannot receive that surgical treatment which is necessary for the prevention of infection ; but treatment by mobilisation and massage is not therefore impracticable when the skin happens to be broken. On the contrary, great stress is laid on the importance of avoiding the actual site of fracture during massage in the early stages, and the fact that the part avoided happens to be the site of a wound is of no moment. It has already been pointed out that a certain amount

of movement is a necessary accompaniment of the treatment of all compound fractures: every change of dressing giving rise to movement in some degree. These movements are, moreover, involuntary, often sudden, never regulated, and act chiefly on the site of fracture. It will hardly be supposed that gentle, graduated and guarded movements of the various joints constitute as great a source of danger as involuntary movements, which is itself regarded as negligible.

Professor Lucas-Championnière recommends the use of mobilisation even in cases where sepsis has intervened. When efficient drainage has been secured, he asserts that rigid immobilisation does nothing towards effecting a cure. He goes further—"It is dangerous, and condemns the limb inevitably to a longer and less satisfactory repair." He claims that the results obtained are even more notable when the fracture is compound than when the skin is intact.

"But," it will certainly be said, "any movement of a compound fracture is liable to dislodge a septic embolus." This danger need give rise to no apprehension provided that the movements are performed in accordance with the principles set forth elsewhere. At the worst

mobilisation will involve less risk than does each change of dressing. "In spite of actual suppuration being present," says the Professor, "movement does not yield those pernicious results which are attributed to treatment by mobilisation."

Sir William Bennett favours the use of massage and mobilisation for cases of compound fracture. "It is not always practicable," he says, "in the early stages. . . . (Later) it can be used as if the case were one of simple fracture, and in the earliest stages of many compound fractures there is no reason why passive movement of the joint most likely to be concerned should not be practised at once, although the fact that the manipulations cannot at first be preceded by smooth massage places the practitioner at some disadvantage."

"At *some* disadvantage," truly, but a very slight one. Let us consider for a moment a profound and little known action of massage—an action obtainable only by such massage as attempts to obtain a reflex action, and discards as unworthy all attempt to obtain a mechanical result. Professor Lucas-Championnière reports that M. Mervy showed to him a man who was suffering from chronic arthritis of both knees. Massage of one knee only had greatly benefited

both articulations. It so happens that in one of my own cases a very similar result was obtained. An old man had been in bed for seven weeks, suffering from "rheumatic-gout." Both shoulders were severely affected, and movement at these joints was limited and painful. Soon after being allowed to leave his bed, he fell down and fractured the surgical neck of the right Humerus. He was treated from the second day by mobilisation and massage, with the ultimate result that movements of the right shoulder were more free than those of the left. This was to be expected ; but the patient volunteered the statement that, as the result of treatment, he was able to move *both* arms more freely than he had done for many years.

Professor Lucas-Championnière points out that such results are not always repeated, even in cases where apparently similar conditions exist ; but that, on the other hand, numerous examples are to be found. And, further, that if we remember the many cases in which alterations have taken place in articulations under the influence of morbid conditions of the nerve-centres and nerves, the potency of massage in maintaining vitality and repairing an injured extremity is readily intelligible. It is, however, only intelligible on the supposition that massage

acts, as undoubtedly it does, directly on the nerves and indirectly on the nerve-cells.

We have seen that massage applied to one extremity is capable of exerting a beneficial effect on morbid conditions existing on the opposite side of the body. Is it, then, surprising that it is claimed for massage that treatment of one portion of a limb may have a profound effect on a morbid condition existing in another part of the same limb? That this is really the case must be the unhesitating belief of anyone who is at all familiar with the treatment by massage described in this book. Those whose experience of massage is confined to its mechanical results will, of course, hold no such belief, the reflex action being unattainable, or at least only attainable to a very slight degree, by their methods.

Massage of the fore-arm is as essential to success as massage of the arm in cases of fracture of the surgical neck of the Humerus : massage of the thigh is no less essential to the treatment of fractures of the leg, and *vice versa*. In one of my earliest cases of fracture through the surgical neck of the Humerus I overlooked the necessity of treating the fore-arm. The last portions of the limb to recover their strength and usefulness were the fingers.

Hence it follows that even should extensive laceration be present much benefit may be derived from massage, even if the nature of the wound prohibits its use at any point between the joints situated at the extremities of the broken bone ; and laceration of such extent which does not entail amputation must be rare.

The same argument may be applied to fracture cases treated by operation. There is no call for delay in commencing massage ; let it be commenced immediately after fracture, continued regularly till operation, resumed as soon as possible, and gradually increased until full measure is again reached with the healing of the wound. To order cessation of treatment for ten days, or even more, to allow a wound to heal after operation is quite unnecessary when the practitioner is skilled in the treatment of fractures by mobilisation and massage. A few hours' delay should amply suffice in some cases, while it should be possible to do much to relieve the pain after operation by massage instead of by morphia. In order to effect this there is no need to introduce the hand into the proximity of the wound. I have massaged limbs with various degrees of raw surface exposed as the result of the formation of blebs, limbs that have undergone recent operation for tendon-suture

and other causes, and limbs that have been operated on for septic infection of the tendon-sheaths. One case which I particularly recall was that of a nurse who suffered intense cellulitis of her arm as the result of a prick while she was working on the district : there were some half-dozen long, deep, gaping wounds between finger and shoulder when massage was commenced.

So gentle and light is the touch that though septic thrombosis were present in the very smallest vessels the clot would not be broken ; it is lighter than the pressure of bandages over thick cotton-wool dressings, and yet it suffices to give intense relief and to hasten recovery. The dose of mobilisation is so reduced that movement is small compared with that which is essential to every change of dressing, yet the patient repetition of all movements possible at each joint through a minute range will finish the work of repair begun by the massage and prevent the formation of adhesions.

The presence of a wound, therefore, is no contra-indication to treatment by massage, even in the presence of septic infection, however dangerous the ordinary methods of massage might be under similar circumstances.

## CHAPTER IX

### ON THE USE OF THE X-RAYS IN THE TREATMENT OF FRACTURES

IT might have been expected that the introduction of the use of the X-rays would revolutionise the routine treatment of fractures. In many places the rays now form part of routine examination which is rightly recognised as invaluable ; but the influence of the knowledge thus acquired has manifested itself in theories of the causation of the various types of fracture rather than in methods of treatment.

One method, indeed, has been advanced by this discovery, viz., treatment by extension in different planes. This represents an advance on the treatment by splintage, no doubt. Although it is difficult, and perhaps unjustifiable, to criticise a method of treatment of which the critic has no personal experience, a few observations may be permitted.

The object of the extensions is to overcome deformity, weights up to 30—40 lbs. being utilised to exert a “long extending pull”<sup>1</sup> in cases of fracture occurring in the lower extremity. Such enormous weights can only be necessary to overcome a force acting in the opposite direction, not merely to correct such deformity as might arise from the weight of the limb acting at the site of fracture. Such force can only be exerted by muscular spasm, since an extension of 8—10 lbs. will suffice to overcome the force exerted by the ordinary muscular tone. It would surely be simpler to overcome the spasm by massage and, if necessary, use the lighter extension, when the “secondary pulls” might well prove superfluous. What the effect of the additional extensions may be on the circulation it is impossible to say without experience.

Some stress is laid by Mr. Pringle on the fact that the pressure exerted by the extending straps “acts much in the same way as massage” in preventing or reducing œdema. When massage replaces extension as the essential part of treatment the use of similar pressure is discarded, not only as being useless but as actually detrimental.

<sup>1</sup> The details regarding treatment by the extension method are quoted from Mr. Pringle’s *Fractures and their Treatment*.

Lastly, to take a concrete example, let us compare the treatment of a fracture through the shaft of the Humerus by the two methods. Mr. Pringle says, "It is surprising how good are the results to be obtained after these fractures by means of the extension treatment." The extension used may be from 10—16 lbs. for three or four weeks, massage may be performed from the outset, passive movements at the end of ten days, and active movements at the end of two or three weeks. The extension, of course, is applied in bed, as it is inadvisable for the patient to move with such a weight dependent from a limb, a bone of which is broken. If the main extension is applied at an angle, or if any secondary pulls are required, it is impossible for the patient to leave his bed.

When massage treatment is applied there is no necessity for the patient to remain in bed at all, though he may prefer it for the first few days; the arm is in use at the end of a fortnight; and by the time the patient with the extension is ready to get up treatment of the other is being stopped, or he may be taking a full dose of exercises to regain the strength required for his work.

The great advantages of the extension treatment over treatment by external splintage are the

greater possibility of restoring the true shape of the bone, the early movements, and the possibilities of early massage. The disadvantages as compared with treatment by mobilisation and massage would appear to be the obvious handicap to efficient massage, the comparatively late mobilisation, and the necessity of carrying out the treatment in bed. Each of these drawbacks must, one would suppose, postpone the ultimate recovery of the patient, while the advantage claimed for treatment by extension in the more exact restitution of the form of the bone is problematical. Neither treatment claims to attain perfection in this direction in every case, but massage treatment, when it fails, ensures so close an approximation to the ideal that it is difficult to imagine that any treatment would be productive of a closer approximation without attaining perfection. Operative measures alone can effect exact restitution in every case, and neither of the two methods we are comparing claim to take the place of operation when that appears to be necessary. Whether this necessity arises less frequently when treatment by extension is adopted in preference to mobilisation and massage it is impossible to judge without experience; if so, then the field for operative interference must be extremely small.

Except, then, for the advance in treatment mentioned, the introduction of the use of the X-rays has had little influence on the methods employed in the treatment of fractures. It has, however, in many instances militated against clinical observation and diagnosis.

Whilst emphatically insisting on the use whenever possible of the X-rays in cases of fracture, one must maintain with equal vigour that such investigation should be undertaken not as a direct means of diagnosis but as an accessory to clinical examination. In the case of a recent fracture there can be no sort of justification for the routine use of the X-rays for the primary purpose of diagnosis, though in dealing with fractures of some days' standing their use may be imperative. Few X-ray examinations can be accepted as complete unless proper account has been kept of the clinical aspects of the case. Professor Lucas-Championnière says, "The duty of a medical man is to forget nothing of the symptomology of fractures. He must consider a radiograph only as a complement to, and as a means of perfecting, his examination. If the result of this examination contradicts the radiograph, the latter is liable to be fallacious."

The function of the X-rays is thus found to be that of verifying the practitioner's diagnosis,

and, at the same time, of enabling him more fully to comprehend the nature of the fracture. The rays may reveal comminution, or such evidence as to the nature of the fracture as may suggest the desirability of operation. On clinical examination such fractures as those of the spiral type are diagnosed as fractures, the extent of displacement may be accurately gauged, and the fact may be ascertained that there exists an insurmountable impediment to the reduction of deformity. Taken in conjunction with the history of the accident, an accurate diagnosis may thus be made clinically ; but it is often impossible to be certain whether on the one hand it is justifiable to undertake treatment except by open operation, or, on the other hand, whether the bony injury is not too severe to allow of such interference with reasonable hope of obtaining a better result than is offered by mobilisation and massage alone.

Again, X-ray examination commonly gives indication of the degree of tearing and separation from the shaft undergone by the periosteum. This indication is of the first importance, inasmuch as by such evidence may be resolved the question of the amount of external splintage to be applied. So it is that X-ray examination indirectly as well as directly assists both prognosis and treatment.

But invaluable for the successful treatment of fractures as is the X-ray examination, no work on the subject of that treatment would be complete unless the errors and dangers incidental to this form of examination were prominently displayed. One such danger we have already noticed, namely, the false sense of security inspired by discovery of satisfactory position of the fragments of a bone when splints have been applied. It has been pointed out how frequently such an examination, though discovering the actual position of the fragments for the time being, fails to give warning of the gross deformity which may ensue, no matter with what nicety of skill the splints may have been applied.

A more signal, though usually less dangerous, error has its origin in the magnifying or minimising of actual deformity by the photograph. To be perfect, an examination must needs be stereoscopic; in practice, examination in two planes at right angles to each other usually suffices. Even so it is better first to form a diagnosis clinically, then allow an X-ray expert to report on the radiographs, and lastly, if necessary, consult with him on any discrepancies. In such cases it will occasionally prove necessary to examine the fracture, or suspected fracture,

on the screen ; whereafter agreement is nearly always attained.

As a final illustration of the dangers of X-ray examination as a diagnostic medium, a resolution passed by the “*Congrès de l'Association pour l'avancement des Sciences à Lille*” in 1907 may be quoted. It reads : “ . . . . . this method of examination, in the interests of patients, should be reserved exclusively for use by medical men.”

My own opinion regarding the proper use of X-rays in cases of fracture is, briefly, that every case should be submitted to X-ray examination in two planes soon after the termination of the clinical examination, when any discrepancies should receive close attention. Should there be deformity, X-ray examination is of value either to record the stages in the process of reduction or to compel attention to the question of the desirability of operation. In exceptional circumstances only should patients be allowed to see their own radiograph ; never for the satisfaction of their curiosity.

Many cases are encountered where it is essential to produce evidence of fracture as a precautionary measure. Patients rarely question the diagnosis of fracture just after accident—most of them realise what has happened and

need no medical confirmation—but it is an every-day experience for doubt to arise in a patient's mind during the course of treatment. I had one patient under treatment for a “back-fire” fracture through the lowest inch of the Radius who had some experience of such injuries, a fellow-workman having sustained a similar injury some two months previously, with the result that he was still suffering great pain, his wrist being stiff and his fingers almost powerless. There seemed no prospect of his return to work for many months. My patient was consequently very anxious. He received an assurance that he would be at work in six weeks' time with sufficiently open scepticism. He came in agony after a sleepless night with an intensely swollen arm, the swelling extending far above the elbow; there was much bruising, and every joint below the elbow was perfectly rigid; the elbow itself was stiff, movement of the joint causing considerable pain. A quarter of an hour later all pain had disappeared, he could move fingers and thumb almost freely, slight painless movements were performed at the wrist, and the elbow movements were completely restored. From this moment he was practically free from pain. In five days the use of splints was abandoned (his friend, so I

understand, was in splints for three weeks), and at the end of a week he was performing various exercises and using his hand for feeding and so on. In a little more than four weeks after fracture he was making his first attempts to drive a car and in less than six weeks he had returned to full duty. The accident occurred in starting a 60 h.p. "Napier," and the force was such that the "handle" was bent into a sort of crooked "S," to use the patient's description. There was great comminution, considerable spreading of the fragments (so much so as to give rise to a slight tendon-insufficiency at one period of treatment), and the joint surface was much broken.

This patient, perhaps not unnaturally, began to doubt the diagnosis during the second week of treatment, and it was difficult to persuade him to "go gently" and avoid excessive use of his hand. The only argument that would convince him of the reality of fracture was the production of a radiograph.

Many similar cases are encountered in which it is necessary to resort to ocular demonstration of the injury in order to avert the catastrophes incident on injudicious use of a limb after fracture.

Again, in cases where any visible deformity

is likely to remain permanent, it is sometimes advisable to exhibit a photograph, as it may assist in explaining the exact situation to the patient. In this way also it may be possible to convince a patient of the desirability of operation when all other form of persuasion has failed.

For such purposes only is the exhibition of radiographic evidence defensible, and then only in conjunction with the interpretation of a medical man.

Professor Lucas-Championnière calls attention to the danger of patients under-estimating the gravity of their accident during the course of treatment, and even goes so far as to say that "advantage may be taken of this idea to prescribe for the patient all movements possible at each joint." An advantage, and, it should be added, a danger. The advantage is that doubt of the reality of injury gives confidence : the danger is over-confidence and the abuse of freedom. The advantage is illustrated in cases of faulty diagnosis, when, fracture being unsuspected, patients are rescued from the dangers of prolonged immobilisation. For such the introduction of the use of the X-rays has been productive of very much harm.

## CHAPTER X

## METHODS OF PROCEDURE

### (I) EXAMINATION

## (2) MASSAGE

PROFESSOR LUCAS-CHAMPIONNIÈRE divides his treatment of a fracture into four distinct stages :—

- (1) Examination,
- (2) Massage,
- (3) Passive movements,
- (4) Active movements.

These processes vary with different fractures, but certain features are common to all.

## ( I ) EXAMINATION

The signs of fracture as usually set forth are trauma, pain, preternatural mobility, loss of function, deformity, and crepitus.

History of accident is usually obtainable, pain is universal (if the sense of pain exist in the part)

affected), but the signs of trauma are often absent if the case is seen immediately after fracture. Loss of function is usual, but frequently only partial, especially in children. Deformity is diagnostic if dislocation can be eliminated.

Trauma and loss of function are symptoms often seen without fracture, and deformity is often absent in spite of fracture ; whence it comes about that preternatural mobility and crepitus are the two main foundations of diagnosis. Preternatural mobility is often very slight and is very difficult of recognition with certainty unless well marked : crepitus, therefore, is generally regarded as the cardinal sign of fractures and it is understood that this symptom should always be searched for before arriving at diagnosis. It is not unusual to examine for crepitus even when deformity is obvious.

In a clinical lecture at the Hôtel-Dieu, Professor Lucas-Championnière said that “the brutal examination” for crepitus, and all painful movements establishing abnormal mobility, must be absolutely prohibited. In his book he says that crepitus is a sign for which it is useless to search, inasmuch as it often presents itself during the gentlest examination, and, unless easily established, is not provoked without danger. Later

he says that in all cases “where it is not encountered accidentally we must guard against the pitiable practice of endeavouring to obtain crepitus by means which lead to a useless displacement of the fragments, in order to satisfy a purposeless curiosity.”

Yet it is an every-day event for patients to be subjected to torture extreme and prolonged in order to satisfy this “purposeless curiosity,” and in order to teach students to recognise a sign which is no more essential to diagnosis of fracture than is egg-shell crackling to diagnosis of an endosteal sarcoma.

Inspection alone may suffice for diagnosis. Otherwise, a fracture being suspected, the most gentle massage possible should be begun. In a few minutes pain will be greatly lessened, and a slightly heavier pressure will be supported except over a certain region where such pressure will still be painful. Massage is continued, pressure being so regulated as to avoid inflicting pain. By means of a massage which “almost resembles mesmeric passes” (and no other is permissible), it is possible to reduce the tender area, originally co-extensive with the greater part of the limb, to a single point of exquisite tenderness. This may be found to be superficial, or it may be necessary to continue the massage until deeper

pressure is well borne except over a circumscribed area. Meanwhile the site of supposed fracture is kept as motionless as possible.

The site of exquisite tenderness being determined, and the patient having been warned, a single deeper pressure is made in order at once to discover the extent of the fracture and thus to avoid as far as possible the necessity for causing further pain in the course of subsequent treatment. From this moment the actual site of fracture is to be avoided. This avoidance of the site of fracture is, according to Professor Lucas-Championnière, "a point of capital importance, for this site should not be submitted to direct pressure. This is the first mistake committed by medical men who have copied our methods." Thus Sir William Bennett says, "You need not be in the least degree afraid of passing the hand over the fracture if it is done properly." And so far he is correct, *if* it is done properly, *i.e.*, if the site of fracture is not submitted to direct pressure. But the doctrine is a dangerous one, and needs an elaboration of the qualifying "if."

It must be understood from the outset that the massage treatment consists of two distinct elements, general treatment for the relief of pain and local treatment of particular parts of the affected member. The former, consisting as

it does of movements so gentle that the word 'pressure' is quite inapplicable, may be performed over the site of fracture: the local treatment entails a certain amount of pressure, quite insignificant however in comparison with the pressure exerted by the lightest massage now in general use. Light though the pressure of the local treatment may be, it is still too heavy to be permitted over the site of fracture.

The general pain of injury having been relieved by massage and the existence of a point of exquisite tenderness being established, the presence of fracture may fairly be presumed. During the course of the examination any deformity will have been noted, and its significance estimated.

During this preliminary investigation crepitus may be felt, though it is usually not until massage has been continued for some time that spontaneous reduction takes place owing to the cessation of muscular spasm; and the detection of crepitus during the earlier stages is frequently an indication that the technique is at fault. Either the pressure is too heavy or sufficient care has not been taken properly to guard the fragments from movement.

It may be necessary to examine the movements at the joints in the neighbourhood of

the fracture with a view to establishing the exact nature of the lesion. In no conditions should any attempt be made to elicit any movement whatsoever until the pain has been completely relieved by massage. Until this freedom from pain is established the muscles are in spasm and have a tendency to act as rigid bands between the points of their attachment : any movement is then liable to be transmitted to the site of fracture, thus tending both to increase the deformity and by inflicting further injury on the periosteum to reduce its value as an internal splint, a value which cannot be over-estimated when the periosteum is not severely torn.

## (2) MASSAGE

What has already been said on the subject of massage must, for the sake of emphasis, be here recapitulated and amplified.

Massage of a recent fracture is of two kinds, general and local. In the earlier stages, as a rule, the former alone is utilised.

The one criterion of the massage is that it should be painless. Moreover, if pain be present the massage must relieve it ; otherwise the technique is at fault.

To effect the relief of pain the injured part

must be so arranged that the position is one in which perfect rest is possible, no attempt being made to move the limb from the position in which it is carried by the patient unless danger to other structures necessarily arises from the position of the fragments. Thus Colles' fracture is treated in a position of full pronation, a fracture of Tibia and Fibula is treated without attempting to overcome eversion of the foot however marked may be the deformity.

In cases of gross deformity one hand must be used for the suitable support of the injured part. In the second of the two cases just instanced, supposing the left leg to have been injured, the left hand would grasp the foot while the right applied the massage (see Figs. 8, 9, 10). After ten minutes the foot is raised from the everted position easily and painlessly, while massage is continued with the other hand. Should the movement be performed too rapidly, or should there be impediment to reduction, the movement will cause pain. The onset of pain, in default of other explanation, is to be taken to indicate that massage has failed to produce a sufficiently profound anæsthesia to allow of the movements being carried out, or that the movements themselves are being performed with undue haste.

The part being arranged in a position of maximum comfort, massage is commenced. The practitioner, on taking up his position, may feel somewhat cramped ; if so, let him hesitate to begin, since *his* comfort is equally essential to success. An attempt has been made to indicate the positions most convenient for patient and practitioner as each fracture is considered.

There is, of course, no necessity to shave the limb. The massage to be used is the "gluco-kinesis," the movements of which are "little more than a caress," being so smooth and light that they "almost resemble a mesmeric pass."

It is well before the actual massage commences to pass the hand over the limb without actually touching it at any point. This ensures that the movements can be performed easily and smoothly, without strain.

Whatever the movement may be, it is to be performed slowly, not more than ten or twelve times to the minute. It must be repeated with inexorable regularity both as regards direction and rapidity. The direction should coincide with that of the venous flow or of the underlying muscular fibres.

The monotony of the movements is very trying at first, and the strain is excessive unless the position of the practitioner is one of perfect



FIG. 8.<sup>1</sup>



FIG. 9.



FIG. 10.

Three stages in the movement for massage of the leg with the left hand prepared to raise the foot from the everted to the perpendicular position. Note the gradual contact of the hand with the limb. The movement commences before the first photograph (FIG. 8) was taken, and ends at a later stage than that shown in Fig. 10.

<sup>1</sup> I am aware that the position of the right hand, with the little finger leading the movement, is regarded in many massage schools as a gross error of technique. To obtain a purely mechanical result from massage, it is advisable to let the thumb and first finger lead the movement as in Figs. 11-13 (page 143); but the method here depicted will be found to yield at least equally good results when the reflex action of massage is sought.

comfort. It will be obvious that only one aspect of a limb can be treated at once, if the movements are to be performed with undeviating direction. This is of no moment: when a sufficient dose has been administered to the one aspect a complete change of position on the part of the practitioner, and also possibly on the part of the patient, will enable a second dose to be administered to another aspect of the limb (see Figs. 11, 12, 13, and compare with Figs. 14 and 15). It must not be supposed, however, that every aspect of the limb requires treatment. The maximum effect can often be obtained without any change of position, and more than one such change is rarely, if ever, necessary.

The preliminary "passes" having been completed without the hand coming in contact with the limb, another such "pass" is commenced, but the space between the injured part and the hand is slowly decreased until actual contact is detected. From this moment the hand follows the contour of the limb without the slightest increase of pressure. The movement of the hand should begin distally to the point of contact and should continue after contact has ceased (see explanatory note Figs. 8 and 10). This ensures that there is no jarring at either end of the movement.



FIG. 11.



FIG. 12.



FIG. 13.

Three positions for massage of the fore-arm. The general line of movement follows the underlying flexor muscles.

The fingers are held close together in full extension and inclined to the limb at an angle of about  $45^{\circ}$  (see Fig. 14). The pad of the middle finger is thus the first portion of the hand to come in contact with the injured part. In other cases it is the ulnar side of the little finger that leads the movement (see Figs. 16, 17, 18). The fingers slowly bend to accommodate themselves to the contour of the limb ; and the thumb, being held somewhat abducted, assists in embracing the limb as far as possible (see Fig. 15). The pressure is regulated by the part of the hand that leads the movement. Every irregularity of outline must be faithfully noted and observed in order that the hand may pass on without check or jar, increase of pressure, or deviation. It does not follow that all movements must be in a straight line, only that, whatever may be the path mapped out by the first movement, it must be adhered to in each succeeding movement, until a complete alteration is made. As the movement is completed the hand is slowly supinated, so that the last portion of the hand to leave the limb is the pad formed by the hypo-thenar eminence (or the adjacent borders of the first finger and thumb, if the little finger has led the movement).



FIG. 14.



FIG. 15.

Two positions for massage of the fore-arm. Note the position of the masseur's left hand soon after the moment of contact, and the manner in which the thumb embraces a large portion of the circumference of the limb. The tips of the fingers follow the line of the extensor muscles.

The extent of a complete movement is most important. It does not coincide with the area of apparent injury, but should include the major part of the limb. Thus in the case of a fracture of the External Malleolus the movement must begin on the dorsum of the foot and extend at least as far as the knee, while very often the maximum benefit will not be obtained until the thigh has received its share of the treatment. If the Humerus is broken the movement must extend from hand to shoulder. With these extensive movements the number per minute will need to be decreased, five or six being as many as can be performed with benefit to the patient.

Local treatment does not imply local pressure. It merely consists of massage similar to that already described, but the amplitude of the movements is diminished.

The most satisfactory methods of administering this portion of the treatment will be found to be as follows. If a small portion of the body is to be treated, such as a finger, or the foot, or any localised swelling, the two thumbs working in unison will be found to yield excellent results (see Fig. 19). If a slightly wider range of movement is required, as in treating the region round the fracture (not



FIG. 16.



FIG. 17.



FIG. 18.

Three positions in massage of the fore-arm with the little finger leading the movements.

the actual site of fracture, which is to be avoided with scrupulous care) it is most suitably carried out by means of the pads of the middle three fingers. The interphalangeal joints are kept fully extended, while the metacarpophalangeal joints, which are fully flexed at

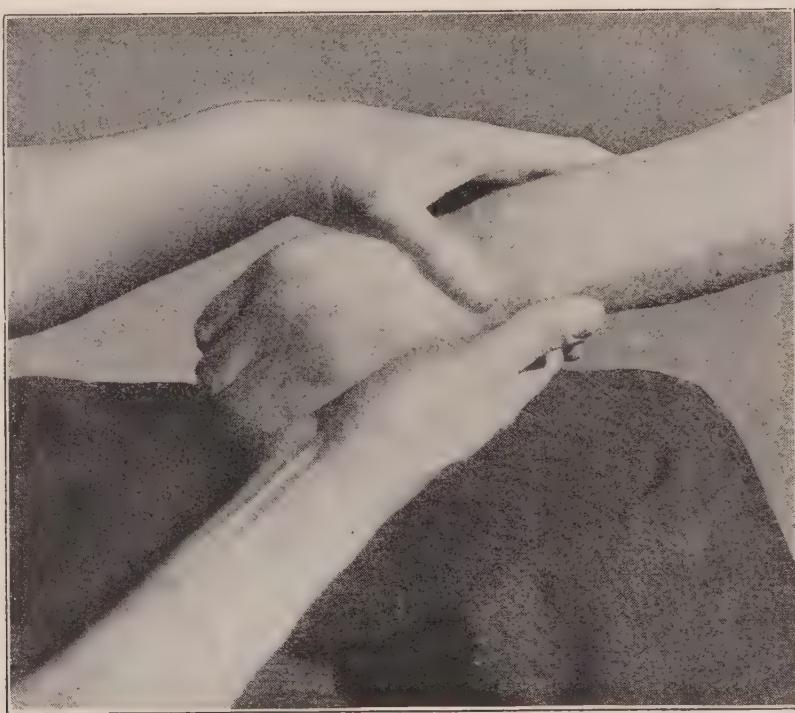


FIG. 19.

Local treatment of the internal lateral ligament of the wrist-joint by the two thumbs.

the commencement of the movement, are slowly extended (see Figs. 20, 21, 22). By these movements a uniformity of pressure and exact repetition of each movement in extent and direction can be obtained with a greater degree of accuracy than by any other method. The repetition of the movements will, of course, be

more frequent as they are less extensive. Some twenty complete movements may be performed each minute : but the rules laid down as governing the more extensive movements must be rigidly adhered to.

When making first experiments with the treatment described above it will appear to the practitioner that his performance is calculated to do as little good to his patient as to his reputation. There is a tendency to feel that nothing is being *done*, that no beneficial effect could possibly follow such treatment. From this arises a desire to "do something" for the patient, and the result is a more energetic treatment. Unless this tendency is combated at the outset a full measure of success will never be attained : good may be done, certainly, but at risk of irreparable injury.

Who then is to carry out the treatment ? At the present time the medical practitioner alone is justified in undertaking the earlier stages, owing to the lack of trained masseurs who can be induced to forgo the accepted usages of their profession and follow instructions implicitly. It is a fact that many a masseur seems to be really incapable of doing what he is told. A minute demonstration with explicit verbal instruction cannot be relied upon to impress the masseur

mind. He may make a conscientious attempt to carry out his instructions, but it seems slowly to dawn upon him either that he is "doing nothing" for his patient, or, perhaps, that the patient is not, as a masseur once said to the writer, "getting his money's worth."



FIG. 20.

It happened not long ago that I treated a severe comminuted fracture of the Olecranon for the first ten days. The patient then went into the country, taking with him one of the well-known London masseurs. The patient, an eminent surgeon, and the masseur both undertook that the treatment should not be changed. A fortnight later the arm was causing intense



FIG. 21.



FIG. 22.

Three positions in the local treatment of the dorsum of the foot and front of the ankle-joint.

pain during treatment, movement was poor, and the arm was practically useless. A minute's demonstration of the treatment that was being inflicted on the patient sufficed to show the cause of the trouble. "Vigorous" is too mild a term to apply to the massage; to one imbued with the spirit of "glucokinesis" it appeared to be little short of brutal. Combined with this were the most violent of forced movements, performed hap-hazard to all appearances. Movement was not complete when the masseur commenced his work: it may be that perfect restoration was impossible from the nature of the fracture, though the limitation should have been infinitesimal. At any rate, I had made no attempt to attain the full range of possible movement, as it was incompatible with a painless treatment. Anticipating the speedy departure of my patient, I had, perhaps, erred in attempting to advance movement too rapidly even without attempting the full movement. The limitation was at once observed by the masseur, who, in spite of assurance to the contrary, attributed it to adhesions. These he was attempting to break down with the best intentions in the world. The actual position of affairs was this. Movement beyond a certain point being still painful, attempts to pass this

point were met by resistance of the muscles, further pressure giving rise to muscular spasm. The application of brute force by which the resistance was to some extent overcome entailed great pain, both at the time and subsequently on movement, with resulting disability. This, in turn, led to lack of exercise, the one perfect means by which the arm could recover strength. More than this, the limb was so painful that it was kept almost at perfect rest between the times appointed for treatment, strength being thus steadily and surely lost throughout the time when, in happier circumstances, exercises should have been prescribed to restore it. And what of the adhesions? A few minutes of gentle stroking, combined with gentle movement, and the masseur himself acknowledged that flexion was more nearly perfect than that which he had been able to obtain. It was obvious that movement so gentle could not possibly stretch the flimsiest of adhesions when now a month old. He would not make the same admission as regards extension: the movement, obtained readily enough, was probably as complete as the nature of the fracture would allow. For the services of the masseur were at once substituted those of the nurse who helped me with my Hospital cases. Freedom

of use began from that moment. Months will probably elapse before the lost strength will be restored in full; prolonged torture has been endured and much valuable time wasted simply because it was deemed expedient to break down adhesions (which in point of fact never existed) in defiance of the most explicit instructions.

It will probably be said that it is impossible for a general practitioner to spend the necessary time on massage, in spite of the fact that twenty minutes a day will prove to be ample for the treatment of the majority of fractures. If this is indeed too long a time to spend on the treatment of one patient, the medical man will be wise to call in the services of a nurse or friend who can be relied upon to carry out the treatment in accordance with his instructions and not in accordance with any pre-conceived ideas on the subject of massage. Even so it is most desirable that the medical man in person should treat the case, or at least superintend treatment until such time as union is complete. Should deformity be present it is essential that personal supervision should be exercised until deformity either has vanished or has been reduced as far as the nature of the case will permit.

An attempt has been made to follow Professor Lucas-Championnière's example in indicating the chief points in the manœuvres of massage, but it must be remembered that a masseur is "born, not made," so far at least as such delicate work as is involved in the treatment of fractures is concerned. The illustrations, therefore, are given merely as a guide, not as indicating laws of procedure admitting of no exception. Presuming a knowledge of the gross anatomy of the part, of the surgical condition, and of the few fundamental rules laid down in this book, all of which can be imparted to a novice in a few minutes in their application to any particular case, instinct alone, aided preferably by experience, will form the safest guide in deciding details of treatment. The technique varies as regards these details in every case not only with the varying nature of the injuries but also with the different mental and physical condition of the patients. To attempt to copy rigorously printed or verbal instructions is to sacrifice the individuality in manipulation without which the indispensable nicety of touch, smoothness, and regularity are impossible.

At no period of treatment is there any advantage to be derived from imparting fine tremors to the hand during massage. Tremors,

though dear to the heart of the massage expert, serve no useful purpose and, if there be pain, are most detrimental.

If at the end of the first week of treatment swelling still persists, the “mouvement en meule”



FIG. 23.

may be employed with advantage. This consists of a rotary movement of the palms of the hands with the fingers and thumb fully extended (see Figs. 23, 24). The pressure applied need not be hard, though it may be a little firmer than

in the other movements. It is not permissible if there is pain.

As soon as union is firm a mild effleurage may be substituted for the simple stroking movements if desired; but little benefit will



FIG. 24.

Two positions in the massage of the shoulder region. The movement is identical with that described in the text as "mouvement en meule."

result from the change. Pétrissage is too violent, even in its mildest forms, but a gentle kneading of the soft parts may yield good results during and after the third week. Throughout treatment, no matter how protracted it may be,

each *séance* should commence and terminate with the plain superficial stroking, the “glucokinesis,” which must always occupy the greater part of the time devoted to treatment.

As regards the duration of the massage each day no definite rules can be laid down. As a rule the first *séance* should last some fifteen minutes exclusive of the time devoted to examination, and each subsequent *séance* from twenty minutes to half an hour. One dose a day will generally suffice, but it is wiser that this should take place in the morning ; then, should pain return during the day, a dose of massage may be administered at night of sufficient duration to relieve pain. Many a dose of morphia may thus be saved.

No useful purpose is to be served by multiplying the *séances* or by increasing their duration. It would seem that a certain interval should be allowed to elapse for the effects of the massage to pass off ; any excess being analogous to the over-training of an athlete, which is due to excessive doses of treatment with insufficient relaxation during which the nervous system can recuperate. It is a well-established fact that the nerve-cells suffer fatigue before the tissues ; and the symptoms of excessive massage are due to irritability (presumably from exhaustion) of

the nervous system. Great care, therefore, should be taken to avoid causing any fatigue in the cells in the reflex arc, which becomes manifest in the form of pain and irritability and which may necessitate an interval in the treatment.

Massage must be continued daily, and as soon as union is sufficiently firm to allow of the use of the limb it may be supplemented by rubbing (not to be dignified by the name of massage if undertaken by the patient himself, nor if by his friends *without instruction*) at home. It is during this time that the evils which follow excess are most frequently seen. The surest safeguard, and one that will often save time and trouble in the long run, is to request the attendance of the future performer at a few preliminary *séances*. The “rubber” thereby becomes a “masseur” so far as that particular case is concerned.

As soon as movement is nearly complete the rubbing at home may replace that of the practitioner on alternate days, and this programme should be persevered with until full strength has been regained. Treatment should be discontinued gradually, daily treatment being replaced by treatment every second, third, and, to conclude, on the seventh day. Occasionally it is advisable to return to daily treatment for a few

days to obtain perfection, such return being described by Professor Lucas-Championnière as a "kind of hygienic toilette," not indispensable, but of value.

Unless the skin is moist there should be no occasion to use any form of lubricant, though it is advisable to dry the hands after washing with a little French chalk before commencing massage. If the patient seems irritable under treatment, or if there is any marked tenderness, free use may be made of the chalk, to which, should occasion demand it, a little boracic acid (free from lumps) or scented toilet powder may be added. Soap and water may be used when necessary: it is an excellent lubricant.

Professor Lucas-Championnière mentions several lubricants. Soap he considers to be too slippery to permit of sufficiently even movements, though he recommends its use (soft soap, without water) for those who lack a delicate touch. Vaseline he considers too tenacious; and for most of his own cases he uses oil. It penetrates the skin and renders it supple, and is easily absorbed. It must be frequently applied, in large quantities: oil remaining on the skin at the end of the *séance* is not a disadvantage, as is vaseline, when splints are applied.

This, so far as I know, is the only point in which my technique differs from that of the

Professor. It has appeared to me that the use of any lubricant other than the softest powder tends to detract from the sensitiveness of the fingers, a loss in no way atoned for by any effect the lubricant may have on the patient's skin. As Sir William Bennett says, "it is the rubbing that does the good."

In her text-book on "The Art of Massage"—a most valuable work for those who have little anatomical training, containing precepts which are generally speaking excellent—Mrs. Creighton Hale says that "the best effects are brought about by almost painless manipulations." Later she says, "I would suggest that any physician, who insists on a masseur or masseuse rubbing without using anything whatever to make the hand glide, should submit to the operation himself for an hour; then let him masse a patient himself for the same length of time with dry hands! I guarantee he would have given his last order for dry-rubbing. . . . One method is comfort; the other torture to both patient and operator." Again, she refers to "the absurd idea of dry-rubbing."

Speaking from personal experience I am able to affirm that the only form of massage advocated in this book does not cause "torture" to the operator at the end of more than six hours consecutive work; and that similar

general massage when applied to myself for more than an hour at a time, under my directions, not only resulted in very marked benefit to the patient but yielded him a sense of comfort quite unattainable by the same masseur when using oil.

I cannot avoid the conclusion that “almost painless manipulations” are, in practice, unknown, or, at least, are not generally utilised. Anyone who can say that dry massage is “torture” either for patient or practitioner should never be allowed to treat any form of recent injury by massage ; while the treatment of a recent fracture would, in the hands of Mrs. Creighton Hale’s tortured practitioner, be attended with positive danger. It is for this reason that the medical man is urged, as things are at present, to keep the treatment of a recent fracture, at any rate in its early stages, in his own hands.

If there is no help for it but to call in a trained masseur, the one way to avoid danger is to instruct him that the only movements to be used are such as he would employ in attempting to relieve head-ache or induce sleep, and that all movements other than those of the lightest possible effleurage are absolutely prohibited. The practitioner must then hope for the best : he will be wise not to expect it.

## CHAPTER XI

### METHODS OF PROCEDURE (*continued*).

(3) PASSIVE MOVEMENTS. (4) ACTIVE MOVEMENTS

#### (3) PASSIVE MOVEMENTS

THIS term, though familiar, is misleading. It seems to denote action by the practitioner in which the patient does not participate, the part remaining an inanimate mass to be manipulated at will. Hence the “passive movement” of everyday practice has degenerated into movements performed regardless alike of the feelings and the wishes of the patient.

True passive movement, except during anæsthesia, is impossible without the contribution by the patient of what may be termed “active relaxation.” Without voluntary relaxation by the patient the muscles are liable to resist any form of externally-imparted movement; so that any such movement, if persistently performed, is the result of a force greater than that exerted

by the muscular resistance, and the movement is, in reality, a "forced movement."

Not only is there a tendency for any movement imparted from without to be opposed, but there is, in addition, a tendency to assist it. This statement may seem to be paradoxical. It is, however, the attempt to assist movement in one direction which forms a source of resistance to movement in another direction, when the practitioner makes the change without the co-operation of the patient.

It is necessary to resort to various devices before really active relaxation can be obtained. Occasionally it is sufficient to tell an intelligent patient to allow the limb to drop on to the hand which is to hold it, but more often one has to arrange the hand and fore-arm under the limb and induce the patient to regard this support as equivalent to that of an arm-chair or a bed. It is sometimes of assistance, by way of lending colour to these devices, to arrange the patient's whole position so as to carry out the idea more accurately. It is a good plan, also, to illustrate on the sound limb precisely what is about to be attempted on the injured limb. This simple preliminary will often prevent the strong resistance offered after other forms of persuasion. It may require great patience to

obtain active relaxation ; but it must be obtained somehow.

Four rules govern this portion of the treatment. The movements must be painless ; amplitude of movement must be sacrificed to frequency ; all movements possible at each joint of the injured limb must be performed (flexion and extension of the fingers are not enough, they must also be abducted and adducted) ; and no joint in the injured limb must be neglected. The fingers must be moved systematically after fracture of the surgical neck of the Humerus, as must the shoulder after a Colles' fracture. I once disregarded the necessity for finger movements in the case of an old man who had sustained the former injury ; the last movement to be regained in that case was full flexion of the fingers.

The movements must also be guided by the same laws that have been laid down on the subject of massage ; they must, that is to say, be performed smoothly and repeated with monotonous regularity, the range of movement being slowly but regularly increased. This is far from being a simple process, particularly as the amount of movement to be allowed varies directly with the degree of success that has attended the preliminary massage. Indeed, as Professor Lucas-Championnière says, "This

intimate association constitutes one of the difficulties of the manœuvre ; and the measuring of the dose of movement demands great tact and intelligence."

The first essential is that all pain must be completely removed by massage before movement is attempted ; and the second that "we must never forget that, although it is of service to provoke frequency of movement, there are great disadvantages in exaggeration of the amplitude. . . . A mild exercise is essentially useful for repair ; if violent, it is detrimental." "Amplitude of movement does not gain the end we have in view ; for instance, Swedish exercises, with their wide range of movement, are not particularly favourable to muscular development. Slight movement, of small amplitude, oft repeated, plays, on the other hand, a great part in the development and regeneration of muscle."

The amount of movement which may be described as "slight" will be found to vary considerably at the different joints, according to the nature of the fracture. Generally speaking, there are always certain joints at which a full dose of mobilisation can be administered immediately after fracture, while at one joint at least movement through an angle of  $5^{\circ}$  is all that should be administered.

Before union has taken place the greatest care must be taken to avoid movement of the fragments on each other, except such as may be unavoidable in the course of reduction of deformity. Some movement is inevitable, and, far from doing harm, actually aids the processes of repair. It is not unusual to feel crepitus during this part of the treatment: it is the signal that mobilisation has reached its danger point, unless deformity is undergoing reduction. It is but very rarely that this crepitus is accompanied by pain or muscular spasm; if it is, the useful limit has been passed, and harm is ensuing.

No movement which may tend to produce deformity, such as extension of the wrist after a Colles' fracture, is permissible until union is complete. If the fracture is such that the fragments can be readily controlled by the hand, this restriction is less imperative, but the movement must be performed with scrupulous care.

The dose of mobilisation must be regular and progressive. It is therefore necessary that the treatment should be performed by the same person until union is so firm that there is no longer any fear of an excessive dose, lest union which is comparatively firm be broken down.

Pain caused by any movement and unexplained by the previous history of the case is usually

due to imperfect or insufficient massage. A short repetition of the first part of the treatment often renders the same movements painless. If painless movement cannot be obtained, all attempt at mobilisation must be abandoned.

The value of mobilisation on the formation of callus has already been noticed, and its value in preventing the formation of adhesions is obvious ; but yet other beneficial effects are derived from it. Spontaneous reduction of deformity may take place during the first stage of treatment as the result of the cessation of muscular spasm ; but more usually it is not until mobilisation has commenced that the reduction occurs. Should manipulation be necessary to effect the reduction the most satisfactory time to choose for the attempt is during the process of mobilisation.

In the case of fractures which involve joint-surfaces the only hope of effecting a satisfactory reduction is to impart suitable movement to the joint. These movements, rendered painless by the previous massage, have the power of moulding into shape any displaced fragment with an accuracy quite unattainable by any other method. With this object in view the dose of mobilisation administered to fractures which involve the joints is always far greater on the first

day of treatment than on any subsequent day, perhaps for as much as a fortnight. The dose is not decreased because it is liable to cause pain ; the anæsthesia of the massage must be sufficiently profound to permit of extended movements, even though the amplitude of the movement is to be limited to a range of some  $5^{\circ}$ . The reduction is made because a regular administration of so large a dose of mobilisation is liable to cause an excessive callus-formation.

From what has already been said, it will be apparent that it is most desirable that mobilisation should be carried out by the medical man in person. If there is the least tendency to mobility on the part of the fragments a certain amount of responsibility must rest on the operator ; when a joint is involved the responsibility is increased. It is certainly unfair that this responsibility should lie upon one who is little more than a mechanical agent. It is difficult for such a person to decide whether a given degree of deformity is immaterial or of vital importance ; he can hardly be expected to decide as to the advisability of X-ray examination ; he is very unlikely to be able to differentiate between the psychical conditions, which call for much discrimination if the fullest measure of success is to be attained. To the

medical man these difficulties are mere phantasms ; his whole training in the observation of signs and symptoms safeguards him from error. A nicety of judgment is sometimes required which experience alone can afford, but in this respect his difficulties will be the same whatever method of treatment he employs. Of one thing he may be sure. The amount of harm which the treatment advocated in these pages can effect is infinitesimal : his only fear need be lest the patient should fail to derive the maximum benefit from his treatment.

One great source of injury to the patient being excess, in any degree, of mobilisation, the dose must be regulated with the greatest care. It may be thought that the minute doses here prescribed will prove inefficient in preventing the formation of adhesions. Yet the man who reflects complacently that he has performed full movements at each joint, or has "given the patient as much as he could stand," during the early stages of treatment, may likewise be sure that these feats are detrimental to the best interests of his patient, even supposing the latter to have been so fortunate as to escape actual, and possibly permanent, injury.

There would seem to be a general belief that, in order to prevent stiffness in a joint after

injury to some portion of a limb, it is essential that the passive movements performed should be the maximum allowed by the anatomical structure of the joint ; and, similarly, that in order to maintain the strength of a muscle it must be made to contract to the utmost limit. But during the ordinary occupations of life few muscles are called upon to this extent, few joints are ever moved to the anatomical limits ; and yet such movement remains possible, the joints being supple to perfection, and the muscles can contract to their full extent without preparation when occasion arises. The muscular strength is maintained by the frequent small contractions of every-day life ; the joints retain their suppleness to the utmost limit by the exercise of movements of small and not infrequently minute amplitude oft repeated.

While fully admitting that the conditions encountered in a normal limb and in one that has sustained fracture are different, yet we are justified in supposing that the same laws of Nature operate alike in the two limbs : there is not one law for the healthy limb and another for the injured limb. Clinical experience amply corroborates this view.

It is true that immobilisation of a limb will never lead to bony ankylosis in a healthy joint ;

but a very short confinement of a limb in a plaster splint will suffice to secure a marked stiffness in the joints. A patient confined to bed may scarcely move hip or ankle for weeks, but the minute amount of movement that takes place at the hip is enough to ensure that the full range of movement remains unimpaired ; while, unless special precautions are taken to administer a minute amount of mobilisation to the ankle, foot-drop occurs as a natural sequence.

Movement, however slight, will suffice to prevent the formation of adhesions, provided that movements are performed frequently and in all directions possible. Where the shoulder-joint is concerned, movements of flexion and extension will not wholly prevent adhesions that might limit abduction : after a Colles' fracture movements of flexion and extension of the wrist cannot be expected to save rotation.

Pathological evidence as to the power of minute movement to prevent the formation of adhesions is not forthcoming, but pathological speculation seems to furnish at least a plausible explanation of the clinical facts. An adhesion is, in its earliest formation, nothing more than granulation tissue. As was suggested when dealing with the influence of movement on the formation of callus, any such granulations laid

down are readily broken by the smallest amount of movement. In the part where the circulation has been restored by massage, and where, as a result, repair is active, the localised hyperæmia, which results from the tearing of the fine granulations, aids the process of repair. This repair would consist of two definite processes : the stimulation to renewed activity of the granulations which are engaged in the repair of bone, muscle, or other structure, and the absorption of those not so engaged. Doubtless the granulation tissue, which is to aid in the healing of muscle or ligament, is formed to excess as the result of movement, in like manner as excess of callus is formed ; but, equally, the excess does not invade surrounding structures unless the amount of movement is likewise in excess of that which is beneficial.

When an excessive dose of movement has been administered, an excess of granulation tissue is no doubt formed, and organises subsequently to form adhesions. We have here a plausible explanation of the harm often found to be incidental to the treatment of recent injury by "bone-setters," as also of the fact that many of their "miraculous cures" of stiff joints are also only temporary. They break down old adhesions, exercising undenial skill in their manipulations,

and thus inflict a “recent injury” on the part. This they proceed to treat with an excessive dose of movement, which ultimately destroys the benefit before bestowed. The medical man, on the other hand, having been taught to treat recent injury, whether accidental or due to operation, by rest, the adhesions in his subject form early instead of late. Medical men of to-day are beginning to lose faith in the prolonged “rest treatment” favoured by former generations; they have before them the errors of the quack “bone-setter”; it but remains for them to determine the mean between the two extremes in order to bring to perfection the scientific treatment of recent injury.

It must be remembered that the minute doses of mobilisation prescribed increase daily in amplitude, that few fractures in the body have been found to fail to unite with considerable firmness at the end of a week or ten days, and that a very unstable union will suffice to permit of a very wide range of movement, if the dose is administered with care and judgment.

But, it may be argued, a newly-formed adhesion is not an elastic structure, and a single movement is as well calculated to break down such an adhesion as twenty. What benefit, then, is to be derived from the repetition of a single

movement? The answer is once more speculative, but is supported by clinical facts. Movement and muscular vitality are inseparable. A true passive movement, say of flexion, permits contraction of the flexor muscles through their own inherent elasticity, if for no other reason, in spite of voluntary relaxation; and, similarly, the extensor muscles undergo a corresponding amount of reflex relaxation. However slight may be the contractions thus created, their value in maintaining the muscular vitality is immense.

If mobilisation is carried out with care and judgment, the formation of adhesions need never be a source of anxiety, and muscular vitality can be maintained until such a time as exercises can be undertaken to restore any slight loss of power which may have been incurred. A source of fatal error is the misinterpretation of the cause of pain during movement. It does not indicate the presence of adhesions: it simply means that massage has proved inefficient, owing to insufficiency of massage or faulty technique; or that the technique of the mobilisation is at fault, vitiated by excessive speed or amplitude of the movements; or that the position of the part under treatment leaves something to be desired; or, lastly, that treatment has been carried to

excess. Pain on movement is not infrequently the result of excess, when it becomes an indication that massage should be curtailed and passive movement altogether abandoned for one or more days.

Although treatment is divided in these pages into distinct sections for the sake of clearness, it should not be supposed that any such divisions exist in practice. The passive movements are not performed alone as a separate part of treatment: rather is it necessary to combine these movements as far as possible with a continuance of the massage. If one hand alone can perform the movements in safety, massage with the other should be continuous. If both hands are required safely to carry out the movements, four or five movements may be performed in the course of a minute, after which massage is again practised for at least two minutes before any attempt is made to repeat the movements.

As a rule it will be found to simplify matters if one tries to vary the movements as much as the nature of the case allows. If flexion and extension are performed three or four times in succession the patient's muscles seem to learn what is expected of them, and they begin to assist the movements. This may be prevented during the time that the movements are of small

amplitude by frequent intervals of massage; and, as soon as the movements have attained a greater amplitude and a greater variety of movement is possible, the same effect may be obtained by allowing a certain degree of a second movement to obtrude itself on the first. For instance, in treating a wrist two movements of pure flexion are administered, and then the third movement is either one of pure abduction, adduction, or rotation, or some combination of these movements with or without the addition of some degree of flexion.

The muscles seem to have a kind of instinctive antipathy to certain movements. Thus, in the case just quoted, there may be the greatest difficulty in obtaining active relaxation for the movement of extension of the wrist. If, however, an ostensible attempt is made to give a dose of rotation, it is often quite easy to take the muscles unawares, so to speak, and to add a considerable dose of extension without encountering the least opposition. When once the movement has been performed, the difficulty seldom recurs. The various devices to obtain active relaxation are innumerable: in the case of nervous, high-strung patients a whole series may be tried before the relaxation is perfect, but there is rarely any difficulty in devising

some method that will prove successful. With experience the difficulties diminish almost to a vanishing-point.

#### (4) ACTIVE MOVEMENTS

When the dose of passive movements has been administered, and before the final massage terminates the *séance*, a dose of active movement is prescribed. This must not be taken to mean that use may be made of the limb at will: simply that certain movements are to be prescribed for certain joints. These movements must be, as were the passive movements, painless, frequent rather than of great amplitude, and comprising every variety of movement possible.

Details of the movements appropriate to each fracture are considered elsewhere, and it suffices here to say that every variety of fracture may, in an extremity, receive great benefit from the prescription of a suitable dose of some movements which under classical treatment are withheld, or at any rate not advised.

The dose is not necessarily administered to the joints nearest the seat of fracture. It is of prime importance that a patient who has sustained a Colles' fracture should systematically

exercise the shoulder and elbow ; while if the Humerus has been broken, even though the fracture be at the surgical neck, he must exercise his fingers. Without definite instructions to the contrary most patients will keep every joint in an injured limb rigidly impassive, and it is surprising how heavy a handicap is imposed by this voluntary immobilisation.

There is, however, a grave danger to guard against, the gravest, in fact, that treatment by massage involves. Relief of pain and freedom of movement will often encourage a patient to walk, or to use his arm, before union is sufficiently firm. This inevitably leads to disaster. The strongest possible persuasion may fail to convince a sceptical patient that a limb is still unfit for use. The only safety, if advice is disregarded, is to prolong the dose of active movements, and to insist on a comparatively rigorous splintage between the *séances*.

In suitable cases the patient may be shown a series of movements which are to be carried out at regular intervals during the day. It is usually possible to awaken in the patient a certain degree of interest in the progress of treatment by the intelligent prescription of regularly increasing doses.

Thus a patient whose fore-arm has been frac-

tured may be instructed that on the first day all the fingers are to be slowly flexed and extended together ; ten movements are to occupy a minute ; after five minutes' rest the exercise is to be repeated. The next day the index and middle fingers are to be moved separately, during the second exercise, and the whole series of movements are to be performed with somewhat greater frequency. The third day each finger is to be moved separately, and the rate of the movements may be increased to fifteen a minute. The next day the tip of each finger in turn may be brought into apposition with the tip of the thumb, perhaps a small pellet of paper may be rolled between them. Then various articles may be picked up, and the hand may be laid on the table in different positions following a prescribed routine. As soon as union is firm, five-finger exercises on table, piano, or violin, and writing, may be prescribed. Then buttons may be fastened, a spoon and fork may be used. The limited use of a knife follows ; the cutting up of meat or the slicing of bread remaining for the near future.

All that is needed is that the prescription shall so vary from day to day as to mark the daily improvement, and that the patient's mind shall be imbued with the fact that each exercise

allowed is no less a definite dose than is a dose of medicine taken out of a bottle. By means of an intelligent dosage an intelligent co-operation is enlisted. Success in prescribing is largely a matter of practice, but the above sketch will serve as a general guide, and the exercises more generally suited to the various fractures will be found elsewhere. The surest road to success is invariably to prescribe such movements as will be well within the power of the patient. Excess spells disaster.

## CHAPTER XII

### ON SPLINTAGE

MOBILITY of the fragments of a bone after fracture is rarely sufficient to give ground for apprehending deformity, save only in the event of external violence. Hence the only precautions to be taken between the times appointed for massage and mobilisation are intended to protect the injured part from such violence, under which heading must be included the weight of the limb and the pressure of support. Where spasm has not been relieved by massage there is, of course, a third factor to be considered.

When possible, protective apparatus is reduced to a minimum by the use of a loose flannel bandage. This will suffice for fractures of the shaft of the Fibula, and for a few fractures of one bone of the fore-arm. A linen sling, suitably arranged, will meet the case of certain fractures of the Humerus.

The next most simple form of splint consists of adhesive plaster applied over a very thin layer of cotton-wool, the wool merely serving to prevent the contact of the plaster with the skin. This may be applied to some fractures through the lowest inch of the Radius (in certain cases) from the outset ; and it also serves as a very useful sequel to other methods of splintage, before perfect freedom is allowed. The application of the strapping requires care, as it causes great pain and swelling if it is too tight. It must never be applied until it is certain that no further swelling will take place as the result of the fracture. It must be applied so as to fit the contour of the limb exactly ; for there must be no pressure. A number of narrow strips are employed, never more than an inch in breadth. They are to be applied separately, the proximal strips being fixed *before* the distal so that they over-lap each other slightly. This allows of massage over the junctions without rolling up the edges. Each strip must lie perfectly flat and completely encircle the limb once (see Fig. 25).

This form of splintage is often successful where swelling is great, and the plaster may tend to aid its reduction. Dr. Wharton Hood explains this by saying that “the skin (under the plaster) cannot expand before the increasing

volume of the muscles as they contract, this increasing bulk must compress the veins, and must squeeze forward any blood or other fluid which may be lying free in the interstices of the tissues." The valves control the venous flow, and there seems no better explanation. It is



FIG. 25.

Application of an adhesive-plaster "splint" to the fore-arm.

certainly reasonable; but some cases respond readily to the treatment and others slowly, which is also a feature of treatment by massage; and it is impossible to affirm that the disappearance of the swelling would be less rapid as the result of massage alone. Dr. Wharton Hood, however, lays great stress on the value of the strapping as a therapeutic agent.

Carefully applied, the strapping does no harm: I have seen great harm done by injudicious application. Also it gratifies patients, who regard it as a new form of splint.

The majority of cases, however, call for a more rigorous splintage; but, be the splint of plaster or not, it must be so fashioned and applied that its removal day by day for treatment presents no difficulty. All splints should be discarded at the first opportunity, on the ground that, however carefully applied, they always exert a certain amount of pressure at one or more points which can only be detrimental by reason of the interference with the circulation. The use of a splint, moreover, of necessity curtails the dose of active movements which it is possible to prescribe.

Under no circumstances should splints be used to correct deformity. All attempts to do so are unjustifiable. Yet, as Sir Alfred Pearce Gould said in *The Lancet* as long ago as 1897, "Most extraordinary ingenuity has been expended in efforts to make splints and bandages do what they are not intended to do and are not capable of doing." The only justifiable use of a splint is to prevent the *recurrence* of deformity. The duty of the medical man is to see that deformity is reduced, as far as his means allow, before

the application of any form of retentive apparatus.

To this end massage should be applied (see Figs. 26 and 27). Many deformities will reduce spontaneously owing to the relief of the muscular spasm. A still greater number will be found to reduce as the result of mobilisation, particularly those which directly involve the joints. Finally, manipulations under the "anæsthesia of massage," as Professor Lucas-Championnière calls it, must be tried. These manipulations must cause no pain, or, at least, only such a degree of pain as may be relieved at once by massage. In children it is possible to secure so deep an anæsthesia by massage that considerable force may be employed without evoking any symptom of pain ; in adults, as a rule, only very gentle manipulation is possible.

Some cases still remain which present a deformity that resists all such endeavours. The pain should then be relieved by massage, and some temporary contrivance applied pending preparation for a general anæsthetic. The use of gas should be discouraged : the anæsthesia is not sufficiently deep, the patient is liable to struggle on recovery, and it does not allow sufficient time for the administration of massage under the anæsthetic. If gas is to be administered



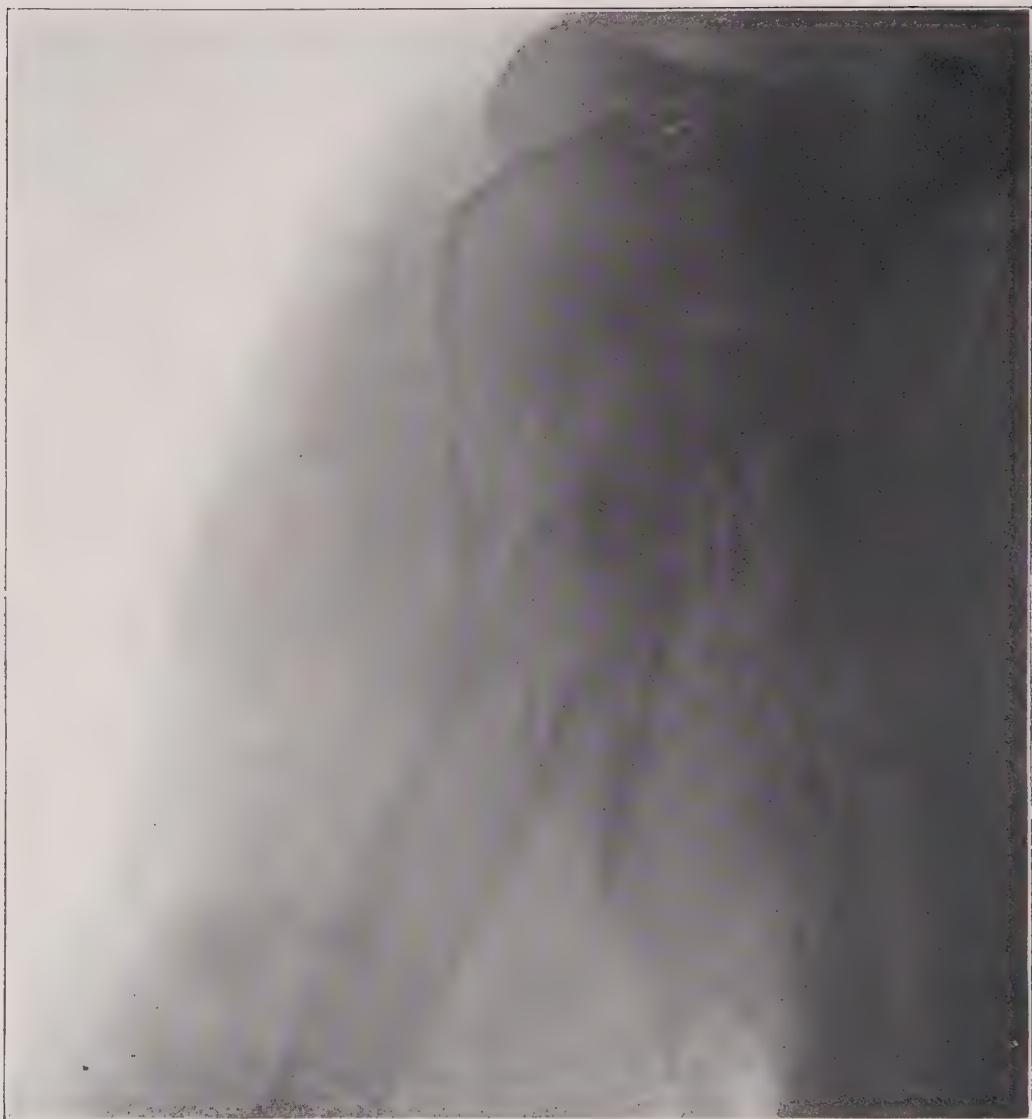


FIG. 26.

Ski-agram of fracture through the surgical neck of the Humerus with separation of the greater tuberosity. Patient, a painter, aged 56. The fracture had been "set" and splintage applied the previous day.



FIG. 27.

Same case five weeks later. This photograph was taken because the patient complained of pain and weakness while white-washing, though able to perform his other work. Strength was not fully restored till about ten weeks after accident. The only apparatus used after the first twelve hours was a linen sling, and the patient walked four miles to hospital and back again each day.

[*To face p. 186A.*



at all it should be combined with oxygen and be preceded by a large dose of morphia.

Open ether, C.E. mixture, or chloroform are the ideal anæsthetics to administer for the reduction of deformity after fracture, the *desiderata* being that the induction should be as smooth as possible, that the duration of anæsthesia should be at least twenty minutes, the recovery free from struggling, and the post-anæsthetic vomiting reduced to an absolute minimum.

The desirability of the avoidance of struggling or straining is obvious, and the prolonged duration of the anæsthesia is required for the following reason. Many deformities recur after reduction under an anæsthetic and the application of splintage. If the splintage is satisfactory, the recurrence cannot be attributed to external agencies, and the only remaining explanation is that it is due to the recurrence of muscular spasm as the anæsthesia passes off. It is essential that all tendency to the recurrence of the muscular spasm should be counteracted by massage (after the reduction of the deformity) before the patient has recovered consciousness.

But it is not only after the reduction that massage is desirable. Complete muscular relaxation, such as is attained only during the most profound anæsthesia, is essential to

success. By means of massage an anæsthesia far less profound will suffice to secure a perfect relaxation.

In sum, then, deformity may be reduced by massage alone, by mobilisation after massage, by manipulation under the "anæsthesia of massage." Failing these means, splintage must be applied pending preparation for an anæsthetic. After the administration, the same routine is again followed, the manipulations being performed with all the care and gentleness that may be possible. If, in spite of all, deformity persists, the advisability of operation must be considered.

The necessity of massage subsequent to reduction under anæsthetic must be insisted upon. If, as so often is the case, the reduction is followed by the immediate application of splintage, the splints not infrequently fail to attain their object, owing, as we have seen, to the return of muscular spasm. In view of this possibility there is a tendency to apply the splints with all the firmness that is compatible with safety. This practice is a source of much pain, and often interferes with the circulation to an extent which goes very near to imperilling vitality, and which materially retards the processes of repair. The massage removes any necessity for

a rigorous splintage, and also promotes the return of the circulation to its normal condition.

The generally accepted law governing the use of splints is that they should be left in position until such time as the broken bones are so firmly united that there is no fear of displacement, whatever use may be made of the limb. Thus a fracture of the Tibia and Fibula is often left in a plaster splint for about six weeks, the patient, on its removal, being able to stand, and being encouraged to begin to walk as soon as possible: the splints, that is to say, have been retained until the bone is strong enough to justify the normal use of the limb. It is true that the duration of the sojourn in the plaster splint is in course of limitation in certain schools at the present day, but the full six weeks is still advocated in at least two of the recognised text-books.

The correct use of splints is to leave them in position until union is sufficiently firm to allow of the *most gentle* movement without displacement, the site of fracture being appropriately guarded. The use of splints for four days will prove sufficient for the majority of fractures, a week for the remainder, except possibly for fractures of the Femur where there has been great displacement and consequent

tearing of the periosteum. It is possible that the early union is due, in part at any rate, to the massage treatment which must be administered before the application of splints. At the earliest possible moment the splint is removed daily for massage. Excepting cases of certain fractures of the Femur, all splints should be discarded within a fortnight from the date of fracture, unless still required as a deterrent.

A distinction must be drawn between union which is sufficiently firm to allow of massage and carefully regulated movements and that which justifies the full performance of all the functions of a healthy limb. The time required for the latter varies, nor is there any method of discovering these variations beforehand, whereas the removal of the splints for massage is always possible at the end of a few days.

Hence we find that, under classical treatment, a patient gains no advantage from the fact that his powers of repair have exceeded expectation, while one whose powers of repair have failed to come up to expectation is doomed to a further protracted dose of immobilisation.

And, further, experience of treatment on classical lines leads to the conclusion that little or no attention is paid by its advocates to the nature of the fracture. A broken Tibia is, for

them, a broken Tibia, no matter whether it is a simple fissure or an extensive comminuted fracture ; the one having an almost normal circulation to effect repair, the other with profound disorganisation of the circulation. Both alike are placed in plaster for a stated number of weeks ; and, be it noted, for a length of time which is calculated to render union in a bone which has sustained the worst possible form of simple fracture so strong that the full weight of the body can be supported.

By the use of massage and mobilisation we not only aid repair, and notice and correct any deformity which may have recurred after the application of the splints (and, it may be, after subsequent X-ray examination), but we can watch the progress of the case, and utilise to the full every advantage that the nature of the fracture or the recuperative power of the patient may afford. It should be ever in mind that functional mobility may be perfectly restored long before functional utility, especially in the case of fractures in the lower extremity.

Taking as an axiom that pain is an indication of the presence of some deleterious process in the treatment of a fracture, and that anything that might cause pain is therefore contra-indicated, it follows that pressure of any sort can

find no place in treatment. While the pressure of an elastic bandage does aid in the absorption of œdema *without* massage, no advantages are to be derived from its combination *with* massage.

Excess of massage causes pain and irritability ; it is for this reason that more than two applications of the treatment are never prescribed for any one day. We must allow the tissues to react to the treatment. Now the application of elastic pressure is a form of continuous treatment, acting throughout the period that should be devoted to pure reaction. Were such pressure applied it is probable that pain and irritability, similar to that caused by an excess of massage, would lead to a cessation of treatment. Such at least would be the danger of pressure during the early days after fracture : at a later stage massage has so reduced the œdema that supplementary treatment is uncalled for. The nearest approach to such an appliance to be used in the treatment of fractures is adhesive plaster, in the application of which to the surface of the skin we avoid pressure with all the care we may.

A vital point in the arrangement of all apparatus, be it a simple linen sling or an elaborate splint, and the detail requiring the greatest possible attention if treatment by mobilisation

and massage is to be a success, is the position of the limb. This must be arranged so that every muscle is at perfect rest, and all tendency to stretching avoided. At first sight this may seem difficult: in reality nothing could be more simple. The most favourable position is that which the patient finds the most comfortable. A sling or splint is arranged in a position said by the patient to be one of perfect comfort. A few minutes are allowed "for things to shake down," when the alteration of a pin, the tightening of a knot, an elevation of half-an-inch, or the like, may make the difference between pain and comfort, failure and success. The only requisites for success are care, patience and common sense, supplemented by a knowledge of the anatomy of the part.

If a splint is applied with even moderate firmness before the œdema has attained its maximum, a marked ridge indicates the limit of the splint pressure by the end of twenty-four hours. The œdema of the distal part is of that tough, doughy consistency which the practitioner learns, after the briefest acquaintance with treatment by massage, to dread. Days must pass before the movement, which should never have been withheld, is restored to the shapeless and rigid digits.

It is useless to attempt to frame rules for routine treatment in the matter of apparatus. No two cases exactly resemble one another, and each requires treatment on its own merits. The nature and extent of injury to the bone and to the soft parts, the causation, the age, sex, occupation, and general health of the patient, must all be considered, and must be regarded as having an important bearing on the treatment to be adopted. Hence it would be no uncommon event to find in a large clinique two fractures of the surgical neck of the Humerus of which one had been treated from the outset in a simple sling without the use of splints, while the other had been in a splint for a fortnight, although the bony injury might have been identical in each case.

Children always require a more prolonged splintage than adults, and women, as a rule, than men.

## CHAPTER XIII

### GENERAL TREATMENT

THE general treatment required in cases of fracture can be indicated, as regards essentials, in a few words.

A point should be made of ascertaining the ability of the patient to live in comfort at home and to provide himself with sufficient nourishment. Failing these necessities patients should be admitted to a Hospital or sent to the Infirmary: they should not be treated as outpatients. They should not be allowed to make too free use of crutches during the first week of treatment.

Aperients should always be prescribed, as the leading of a sedentary life is unavoidable, at least in the early stages. Salines are selected on theoretical grounds. It is generally acknowledged that massage increases metabolism. This, in turn, increases the amount of work done by the kidneys, organs which, as Professor Lucas-Championnière has it, “excrete laboriously and

easily exhaust themselves." It is wise, therefore, to give them all the relief possible, "and to evacuations of the bowels belongs this task." Investigations of the urine during massage treatment have shown that changes are present identical with those found after severe muscular exercise.

To patients in better class life the use of any of the various aperient mineral waters may be recommended.

When the bowels have been freely opened a tonic is often of service, a bitter if possible; but, especially with female patients, the prescription of a sedative for a few days renders valuable assistance in dispelling the effects of shock.

Hot-air baths are not indicated in any form of recent injury if efficient massage treatment is obtainable; nor when a fracture is no longer recent should such indication appear if treatment has been satisfactory. The value of baths in the treatment of the effects of immobilisation cannot be over-estimated.

## CHAPTER XIV

### CONTRA-INDICATIONS

THE contra-indications to the treatment of fractures by mobilisation and massage are four in number :—

- (1) Mobility of fragments,
- (2) Skin lesions,
- (3) Extreme youth of patient,
- (4) Extreme age of patient.

None of these conditions are absolute contra-indications.

#### (1) MOBILITY OF FRAGMENTS

The denial to a patient of the benefits of this treatment on account of the dangerous mobility of fragments is foreign to my experience, though I have treated many cases in which mobility of fragments has been a marked feature. Very great care may be called for in manipulating the limb, and some ingenuity is

often wanted if apposition is to be maintained, but skill and patience will usually be rewarded. It is at first somewhat terrifying to feel the sharp edge of a fragment of a broken Ulna, Tibia, or Clavicle, starting up prominently under the surface of the skin, but one soon regards such conditions with equanimity, provided the skin is intact. I have treated many such cases by the methods I advise, and have found that the deformity disappeared readily, never returning to cause further anxiety. What force is required to pierce the skin with a fragment of bone I cannot say—it must be considerable—and I feel sure that had splint pressure been continued on some of the prominences which I have been called upon to treat the skin would have sloughed and the fracture would have become compound. It is not unusual to see the skin red and “angry” over the site of fractures even when there has been but little prominence.

In careless hands mobility of fragments may endanger the integrity of the skin, but danger can be avoided by the simple expedient of taking precautions to prevent all movement until prominences are discovered, while removing any covering over the suspected fracture. If prominences are discovered, one must be careful to see that any pressure exerted is such as to drive the

projecting fragment inwards rather than outwards.

On the morning of the day of writing two cases in point presented themselves: one a girl of seven with a fracture through the middle third of the Clavicle, the other a boy aged five with a complete fracture of Radius and Ulna. Certainly both fractures had been "set" with skill and accuracy prior to the application of adhesive plaster in the first case and of anterior and posterior splints in the second. Both presented sharp prominences under the skin surface. By careful treatment the deformity was reduced in either case until it was impossible to detect any prominence whatsoever, and splintage was re-applied in the confident anticipation that the deformity would not recur, thanks solely to somewhat prolonged massage. During the whole course of treatment neither child exhibited any sign of pain or uneasiness, but ate sweets contentedly throughout. Incidentally, a supply of sweets is an invaluable auxiliary in the treatment of fractures in children.

Injury to soft parts due to mobility of fragments gives genuine cause for apprehension. I have never had experience of this calamity as a consequence of fracture, though I have known the most disastrous—in one case fatal—results

to follow dislocations of the shoulder-joint and their reduction. I can only infer from my failure to note such accidents after fracture that they are less common than—thanks, it may be, to an exaggerated estimate of the mobility present after fracture—is sometimes supposed. While it is undeniably true that the mobility which exists in some cases may admit of sufficient range of movement of the fragments to cause injury, such cases, it may confidently be submitted, are of great rarity. For example, it is generally taught that the lower fragment after a Colles' fracture is frequently liable to change its position, and that splints must, therefore, be kept in position for from four to seven days. I have treated some eighty cases of this fracture : such mobility has been present in two only. The idea of mobility of the lower fragment being present as a general rule after fracture through the lowest inch of the Radius has arisen, presumably, from the fact that, in spite of the greatest care in reduction, even with the aid of an anæsthetic, there remains, almost invariably, some bony deformity. To overcome this imaginary mobility splints are applied so firmly and for such a length of time as to endow the deformity with a far greater importance than it in fact possesses. The actual

cause of the persistence of the deformity is, of course, the impossibility of complete reduction.

Even when mobility of the fragments is present in a marked degree after fracture it does not necessarily deprive the patient of the benefit of massage. The fragments can be controlled by appropriate position, support, or extension maintained during treatment, and by the use of splints in the intervals. I have daily massaged a fractured arm in which the mobility was such that the fragments of the broken Humerus had ruptured the outer half of the Triceps right through to the skin. Union took place in excellent position. No better result could have been obtained by plating, and it was possible to control the fragments so well that even crepitus was rarely noted during the manipulations, deformity never.

Where there is gross deformity after fracture, the movements of the fragments which caused it may work injury, as may the movements necessary to reduce the deformity ; but, these dangers past, if by splintage or extension the fragments can be kept under such control that fear of further injury to the soft parts is thereby removed, then the number of cases to which massage should be denied on the ground of mobility is exceedingly small.

I believe that it is the rarest possible accident for the periosteum to be torn completely through all round the circumference of a bone as the result of fracture, and that it is but very occasionally that only a shred is left. In many cases the periosteum must remain almost intact ; otherwise one is at a loss to account for the lack of displacement so often noticed after fracture in spite of the weight of a portion of a limb acting on the site of fracture, or for the usual limitation of displacement within remarkably narrow limits. The unbroken periosteum, acting as a natural internal splint, plays a large part in limiting mobility of fragments : and that the strength of such splintage may be relied upon is shown by the futility of the most violent efforts to reduce deformity when one end of a fragment has “button-holed” through the periosteum.

In treating fractures of the Humerus a common danger is supposed to be injury to the Circumflex or Musculo-spiral nerves, according to the position of the fracture. Any injury likely to be inflicted on these nerves must occur at the time of fracture or during “setting” ; and the harm, if done, cannot be made worse by the slight amount of mobility allowed to the fragments during treatment by mobilisation and

massage, while such movement is not calculated to injure the nerves if they have already escaped during the wider movements of the fragments.

But treatment by massage tends to cause an excessive formation of callus. Is there, then, no corresponding increase of danger that these nerves should become involved in the callus? It was not until recently that the true solution of this difficulty dawned upon me while studying an X-ray photograph of a separation of the lower epiphysis of a Radius with considerable backward displacement. There was a large amount of callus present at the back of the lower end of the Radius, and yet it was obvious that no structure originally lying in contact with the bone in this position would have been involved in the callus. The reason was that the periosteum, which originally separated the soft parts from the bone, now separated them from the callus, just as, after fracture, it separated them from any sharp ridge of bone which might have been present.

It is evident, therefore, that for the Circumflex or Musculo-spiral nerves to be involved in the callus formation it is necessary that the periosteum should be torn at the points where these nerves are in contact with the bone. Moreover, be the amount of callus great or

small, the nerves *must* become involved if the periosteum is torn at these points as they are now in contact with the bone itself. As there is always a certain amount of super-abundant callus formed, the fate of the nerves is sealed if once the periosteum is torn in the positions indicated, and I cannot believe that the injury is any less if the nerves are caught in the ordinary super-abundant callus than if caught in the slight excess caused by treatment by mobilisation and massage.

The rarity of these accidents is doubtless to be attributed to the peculiar strength of the periosteum at the points of danger, due to the insertion of strong muscles in the neighbourhood.

The benign growth of callus may be compared to the malignant growth of a sarcoma, both alike possessing many of the characteristics of embryonic tissue. While the capsule is intact only localised growth takes place, and no surrounding tissues are involved : once the capsule is torn the growth spreads, infiltrating the surrounding tissues to a small extent, and locally, in the case of the benign callus, while a general infiltration follows in the case of the malignant growth.

There is, therefore, no reason to fear any evil effect from the excess of callus which may form

as the result of massage treatment so far as the involvement of nerves is concerned ; while any trivial harm which may result from the greater involvement of the vessels or of the origin of muscles is more than compensated by the lack of adhesions and matting together of the soft tissues.

When speaking of fracture of the Humerus in the neighbourhood of the elbow, Mr. Pringle says, in his "Fractures and their Treatment," that "when union does occur, it frequently happens that excess of callus is produced. . . . This callus production is the result of laceration of the brachialis anticus, and the consequent extravasation of blood, into which bone-cells penetrate and produce these masses of new bone." He does not mention on what evidence this statement is based, or whether it is merely speculation. If this be indeed the true explanation it is a curious coincidence that the first cases of these fractures which I treated with a marked over-dose of mobilisation should have presented an excessive callus formation, while it has never been present since the dose was reduced. It is true that a similar excess is seen when strict immobilisation has been employed. But, realising the danger of excessive mobilisation, every care is taken to ensure that no movement

takes place in the limb between the times appointed for the administration of the regulated dose. Yet it is not unusual to find that there is a tendency for the apparatus used to become loose at the end of twenty-four hours. Is it surprising, therefore, that a considerable amount of movement should be possible at the end of three days or a week? And yet, if immobilisation were the treatment favoured, it would be a very conscientious practitioner who examined and readjusted the splints at more frequent intervals than those suggested. The recovery of the circulation in children is so rapid that massage is never required for the treatment of a child as it is in the case of an adult. Knowing that excessive mobility without massage will cause the excessive callus formation in the cases under consideration, and knowing the extreme difficulty of attaining a perfect immobilisation in children for any length of time, is it not probable that the excess of callus which is seen after a comparatively prolonged splintage is due to mobility of the fragments, and not to ossification of blood-clot in the interstices of the muscular fibres, be they broken or intact? At least it is a second curious coincidence that similar infiltration does not occur after other fractures where a more perfect immobility can be

maintained, when treatment by rigorous splintage is employed; and that it has failed to occur in several hundreds of other fractures treated by mobilisation and massage, when the dose of mobilisation administered has not been excessive, in spite of the fact that not a few have presented features that must have caused extensive injury to the muscles, even when direct evidence of such injury has been lacking.

## (2) SKIN LESIONS

It is hardly necessary to say that massage is impossible over an open sore; though it may be applied to a leg for the treatment of a fractured Malleolus in spite of a grazed shin. If the injury is not sufficiently severe to demand amputation it is on the rarest occasions only that massage is altogether contra-indicated. One such rare case was that of a fireman whose leg had been crushed by both wheels of a fire-engine, the whole limb being almost immediately covered with cutaneous blebs. Massage was impossible for nearly two months. No bones were broken.

In the case of the man already mentioned whose arm was crushed between the buffers of two railway-trucks, although the cutaneous

bullæ must have covered a total area of ten or fifteen square inches it was possible to practise massage over the whole of the fore-arm, except on the inner side, and over the whole of the front and most of the back of the arm. This restricted massage proved sufficient to yield the most remarkable results.

The difficulties encountered in avoiding the raw surfaces may be easily overcome ; and, as already pointed out when dealing with the possibility of the treatment by massage of fractures after operation, very great benefit may be derived even in those cases where massage is impossible over a complete segment of a limb.

Should the raw surfaces of a wound be septic, a somewhat wider area should be avoided during massage on account of the possibility of loosening thrombi in the veins ; but the patient's condition may still be greatly improved by the treatment.

The question of increasing the dangers of thrombosis or embolism is often raised. Provided the massage is carried out as advised the danger is negligible, though it may readily be believed that the ordinary methods of massage, by their violence and lack of smoothness, might increase these dangers.

Thrombosis and embolism are sure to be met

with after fracture, regardless of the treatment, as anyone with a wide experience of these cases knows well enough. No such catastrophe, however, occurred in dealing with a series of cases (upwards of five hundred) where treatment was confined exclusively to mobilisation and massage. Yet I well remember seeing, as a dresser, one case of fracture of the surgical neck of the Humerus which had been immobilised for about six weeks. A few days after the removal of the splints the whole limb suddenly became intensely swollen and tender. It is true that the house-officer in charge of the case attributed the condition to an acute attack of gout ; but it was a most unusual attack of gout, and rather resembled the condition one would have expected to see had thrombosis occurred in the axillary region.

It is a little difficult to estimate the relative liability to embolism during the course of the various methods of treatment, but there can be no question that any method tending to restore the circulation in the injured limb must also tend to reduce the liability to thrombosis. Beyond question also is the fact that treatment by mobilisation and massage is the only method of treatment which makes treatment of the disordered circulation the first step in effecting

the cure of the injury. Early massage is recommended in many cases during the treatment of fractures by the extension method ; generally also in operation cases after a delay of perhaps ten days. Valuable though this early massage may be, the delay, however short, can only tend to permit of the formation of thrombi more readily than if massage is administered from the outset.

With the reduction of the liability to thrombosis, we are justified in assuming that there is a corresponding reduction in the liability to embolism ; always provided that the massage is performed in such a manner that no risk at all is run of injury to any clot which may have formed, no matter how delicate and slender the clot may be.

### (3) IN THE VERY YOUNG

Children do not, for some reason, respond to massage as do adults, at least during the first decade of life. Professor Lucas-Championnière says that the tissues re-act more readily, and that the callus is more sensitive, whether by reason of the greater sensitiveness of the nervous system, or of the greater vitality of the bones, or of the readier secretion of the periosteum. "In children," he says, "it is very easy to cause the formation of exuberant callus to the verge of

deformity. I have seen it after fractures of the fore-arm and of the Clavicle which have been massaged heavily. In these cases I have not seen any serious results. Nevertheless, it has been necessary to leave the patients in absolute immobility until the callus has been reduced to a normal amount." "Be it well understood," he adds, "that I have never seen these conditions in the cases of patients where I have myself superintended the treatment." He goes on to say that he has frequently applied massage to children, even of the tenderest years, with perfect success and great rapidity of convalescence after fracture.

Whatever may be the cause, the fact remains that callus is invariably exuberant after fracture in young children, and, if perfection is to be attained, due account must be taken of this phenomenon.

But the vitality of infantile muscles is such that they suffer little from immobilisation as compared with the almost immediate wasting seen in the case of adults, and the joints remain supple. It would appear, therefore, that there is little reason to diverge from the traditional treatment of fractures in children.

Still, although the muscles may not waste or the joints become stiff, pain is often felt

both in muscles and joints after immobilisation. As Professor Lucas-Championnière says, "fractures of the lower end of the Humerus furnish us with many examples"; and the writer has seen many children treated by immobilisation who have exhibited a marked limitation of movement, even when the site of fracture has not been in close proximity to any joint. He has frequently given anæsthetics and seen them administered to children with the idea that adhesions had formed which required to be broken down. On unconsciousness being attained movement was found to be perfect, nor was any evidence of the presence of adhesions discernible: on recovery from the anæsthetic the condition remained as before.

These "functional joints" in children are simply the result either of muscular, or joint, pains following immobilisation, or of passive movements which have been performed without antecedent "active relaxation," that is to say forced movements which have caused pain. Prolonged treatment, great patience, and considerable tact are needed to effect a cure in such cases, in which the condition tends rapidly to become one of permanent disability. A treatment should, therefore, be devised to eliminate the cause of that condition.





FIG. 28.

Fracture through the lower third of the Radius in a small boy. The deformity was reduced painlessly the day after fracture under the "anesthesia of massage." The value of examining a suspected fracture in two planes is well illustrated.



FIG. 29.

[To face 212]

Such treatment is found in mobilisation, itself a painful treatment after recent fracture and therefore only admissible when sensitiveness has been allayed by massage ; which in turn, as already stated, is liable to cause an excessive formation of callus.

A nicety of judgment is called for which can only be acquired by experience and close observation. There is but one rule of treatment :—never hurt a child ; or, should it be necessary (as it often is not) to give pain in correcting deformity, never tell a child that it is not going to be hurt (see Figs. 28 and 29). Nothing is easier than to gain a child's confidence when the difficulty of treatment is over ; but to deceive it is to inspire a distrust which renders effective treatment other than by immobilisation impossible.

The procedure is to use simple massage until some slight movement can be obtained painlessly. This will be after a few minutes, the movement being obtained almost spontaneously, whereupon massage should be reduced to a minimum. In the course of a few days massage may be abandoned altogether, and treatment by mobilisation alone continued until union is sufficiently firm to permit of use of the limb.

A generally reliable indication as to whether

mobilisation may be practised without preliminary massage is found in the presence and extent of swelling. If the swelling is marked, movement is almost invariably painful without the assistance of massage, and until all swelling has gone from a limb massage, in moderation, should be continued. It need hardly be said that only the most superficial massage, the movements "resembling mesmeric passes," should be attempted. By such treatment pain in muscles and joints and tenderness of callus are overcome, and the fear of "functional" disability—I have known it almost to amount to ankylosis—need scarcely be entertained.

It is difficult to estimate the frequency of the occurrence of these "functional" disabilities following fractures in children. Three such cases have come under my recent care, and I have a vivid recollection of seeing many children brought up to hospital for so-called passive movements. I fancy, therefore, that the trouble is fairly common.

Nor is it easy to account for the pains children suffer in limbs which have apparently completely recovered from the effects of fracture. The joints are freely movable under an anæsthetic, and there can therefore be no contracture of muscle. I have labelled the pains "functional,"

and believe them to be the direct, almost the necessary, result of the treatment to which the patient is subjected.

Let us suppose that a little girl, five to seven years of age, has fallen down while playing and sustained a supracondylar fracture of the lower end of the Humerus. She is picked up in great pain, and is terrified by her accident. When it is realised that the arm is hurt, it is usually examined by the parents, and the pain thereby aggravated. The child is then taken for medical attention. Examination reveals pain and loss of function, there may or may not be obvious deformity, which again may, if present, be masked by the rapid swelling. Preternatural mobility is rare, unless, indeed, hyper-extension of the elbow is investigated, which should never be the case. Fracture being suspected, the child has to endure the pain entailed by an attempt to establish the presence or absence of crepitus: if present, it will be accompanied by *gross* deformity which suffices for diagnosis; if absent, the result of the effort which demonstrates its absence may cause a needless displacement of the fragments. The fracture may then be "reduced," if it is deemed necessary.

When the child has been subjected to pain so acute and prolonged as sometimes to amount

almost to actual torture, a pad is placed in the ante-cubital fossa, and the forearm is flexed to its full extent and bandaged firmly to the arm. The victim is then sent home to bed to wait through hours, it may be days, of misery while the pain wears off. It is small wonder in these circumstances that, on the removal of the bandages, the child braces her muscles and resists with all her might the doctor's attempt to bend her elbow, having vivid memories of the pain he caused at the previous interview. But, the value of "early movement" in these cases being well recognised, pressure is exerted until the resistance of the child's muscles is overcome and the elbow is moved. This new infliction is repeated regularly at stated intervals. It would be difficult to devise a treatment better calculated to cause "functional" disability.

Compare this with treatment by massage. The frightened and suffering child is brought to a doctor who, in a few minutes, causes all pain to vanish by means of gentle stroking. Deformity, if present, may reduce spontaneously with the cessation of muscular spasm, when crepitus will be felt: if manipulation is called for it may be performed with a minimum of pain, relieved again almost instantly by massage. A general anæsthetic is not infrequently

required if any length of time has been allowed to elapse since injury ; but in no event is the infliction of any severe pain to be countenanced. If deformity is absent in these cases, so also is crepitus. I have only felt it twice, except during reduction under an anæsthetic, and it is, apparently, always difficult to elicit even when deformity is present. The presence, nature, and position of the pain, together with the limitation of movement, will indicate a diagnosis at least as accurate as one arrived at by the methods previously described.

The child being free from all pain, a sling, with or without an internal angular splint, is applied, and she is sent home to bed, where sleep will probably soon follow the pain and excitement of the day. Even should the pain return (it is a rare event in children), she will not dread a visit to the doctor ; but, rather, remembering the instant relief afforded previously, will submit willingly to massage and such movement as he may see fit to prescribe.

Under such treatment all fear of "functional" disability vanishes : such, at any rate, has been my experience since I reduced the "dose" of mobilisation in these cases on the advice of Professor Lucas-Championnière ; while the disability encountered before reduction of the

“dose” was, thanks to massage, the mechanical result of excess of callus rather than “functional.”

#### (4) IN THE VERY OLD

Professor Lucas-Championnière states that very aged subjects re-act badly to massage, although mobilisation is particularly advisable after fracture. Advanced age is, therefore, included here as one of the contra-indications to massage and mobilisation in the treatment of fractures.

My experience of fracture occurring in the very aged is necessarily small ; since, in these subjects, fracture is always so serious an accident as usually to ensure the admission of the case to the wards. It has, however, fallen to my lot to treat at least five cases of fracture in patients over seventy, and a considerable number where the age was between sixty-five and seventy. Among the former were two cases of fracture of the surgical neck of the Humerus, one being the case of a man in his eightieth year. It will be remembered that these patients were compelled to travel from their homes to Hospital : a serious undertaking for such elderly people after severe injury. I have seen nothing in the treatment of these cases to suggest that massage was unsuitable :

they all benefited greatly therefrom, both in respect of early relief from pain and of subsequent rapidity of convalescence. One very decrepit old woman of seventy-nine had passed a sleepless night of pain after fracture of the Clavicle. Her condition was pitiable in the extreme, but it proved possible entirely to relieve her pain by massage and so send her to the Infirmary in comfort.

My own experience, therefore, in the treatment of the aged has been so encouraging that I should not hesitate to advise massage after fracture. It may well be that the very aged respond indifferently to the severe forms of massage. It is quite conceivable that the majority of movements might be detrimental; but I feel sure that the only form of massage ever permissible after recent fracture will be fraught with nothing but benefit to old and young alike.

Speaking of intra-capsular fracture of the neck of the Femur, Sir William Bennett says that “. . . any person with a moderately soft touch can give more comfort in a case of this kind than all the narcotics in the pharmacopœia.” Professor Lucas-Championnière goes further, and says that the traditional treatment in bed “is death, slow or quick, for most of these cases.

A large number of people succumb, not to the fracture of the neck of the Femur, but to the treatment they are made to undergo. . . . These fractures may present occasion for massage : they certainly present an excellent opportunity for treatment by mobilisation."

As the fractures in question are found for the most part in people of advancing years, it is evident that the Professor does not wish it to be understood that massage may be the source of possible danger to the very old that it is to the very young. We may take it, then, that his warning indicates that advanced age is no absolute contra-indication to massage, but rather that proper allowance must be made for the age of the patient, and the massage performed with more than usual caution. To mobilisation must be awarded the most prominent part in the treatment ; while the massage performed must never be allowed to pass the stage represented by the term "glucokinesis."

But although we need not hesitate to commence the treatment of any fracture with massage regardless of the advanced age of the patient, we must guard very carefully against fatiguing the nerve-cells in the reflex arc by excess ; and the safer course for a practitioner who cannot rely upon skill begotten of special

experience is perhaps to abandon massage when confronted by a patient of great age and decrepitude.<sup>1</sup>

<sup>1</sup> When reading the MS., Professor Lucas-Championnière inserted a note to the effect that, as far as he personally was concerned, he had frequently applied massage to the very aged ; but that massage applied by others, on whom it was impossible to rely to perform the treatment according to his instructions, was fraught with such danger that he had refrained, but only as a matter of precaution, from teaching that massage treatment should ever be administered to a very aged patient.

## PART II

# DETAILS OF THE TREATMENT OF INDIVIDUAL FRACTURES

### CHAPTER XV

#### TREATMENT OF INDIVIDUAL FRACTURES INTRODUCTION

HAVING studied Mr. Arbuthnot Lane's paper entitled "Fact and Fiction, or the Prognosis in Cases of Fracture" in the *Practitioner*, 1909, and Mr. Clinton Dent's address before the Medical Society in 1908, in which the speaker gave the result of his observations on the after-effects of fracture in the case of certain members of the Metropolitan Police Force, I have endeavoured to confine myself to "fact" in considering my own results, and have abjured the compounding, from a conglomeration of my facts, of an extract of "fiction" in the form of averages.

"Recovery from the point of view of the

surgeon and that of the patient does not always coincide in date," says Mr. Dent. This is a fact, no doubt; but one who has had the patience to massage and move a limb daily for periods varying from ten days to six weeks is not so prone to become impatient of slow recovery as one who has treated a similar case for from three to six weeks in splints. The latter practitioner is apt to regard the use of splints as the alpha and omega of treatment, and to be intolerant of a patient whose fracture is "cured" and who yet professes inability to use the injured limb for many months thereafter. When the patient escapes the suspicion of malingering, he is handed over for subsequent treatment to a masseur who is left to struggle indefinitely with the results, not of fracture, but of treatment; the case being classed as "cured" on the day massage was begun.

Misapprehension of the length of time which has to be devoted to the after-treatment of cases of fracture first treated by immobilisation has done much to spread a belief either that nothing more can be done for a patient who has not recovered the use of a limb after a week or two of simple massage following the removal of splints or that treatment is altogether ended with their removal. The error is in part due to

lack of teaching on the subject, but there is also the fact that opportunity is rarely afforded to the average student of following the progress of his cases after the removal of splints and the commencement of specialised treatment by massage and exercises. Even granting the opportunity, the number of cases watched from start to finish would be but few during a three-months' course of out-patient dressing if immobilisation were the treatment employed.

Again, in cases of fracture admitted to the wards a student, as a rule, loses all touch with his patients as soon as they leave the ward. A personal reference will illustrate this fact. As a house-surgeon I was particularly fortunate in the dressers appointed to work with me. They were as keen and conscientious workers as the most exacting H.S. could desire ; but fractures were the only cases which, taken as a whole, failed to rouse them to any enthusiasm. They were kind enough to accept my attempts at instruction with patience, but, I fear, with little interest, with the result that they lost sight of their cases as soon as they left the wards and had had their plasters removed.<sup>1</sup> A few cases—four, I believe, to be exact—they were good enough

<sup>1</sup> I was compelled, owing to pressure of work, to modify my treatment while acting as H.S.

to treat as I could have wished all such cases to be treated, but I believe this was done for my sake rather than in their own or their patients' interests.

It is, then, no exaggeration to say that when the average practitioner commences his career the sum total of his knowledge of the prognosis of fractures is limited to the notion that a patient will "soon be well" after the removal of splints, and a sort of vague idea that some cases seem to drag on in a most incomprehensible manner.

It is this ignorance of the course of convalescence and of the after-treatment of cases of fracture which paves the way for an unending supply of work for the quack bone-setter, so bringing discredit on the profession and forming a source of much "fiction" whence are derived statistics upon which the prognosis of fractures is based. No one not intimately acquainted with the work of the Physical Exercise Department of a large general hospital, or possessed of experience such as is gained by few except bone-setters, can have more than a faint conception of the appalling results of fracture when treated by unmitigated immobilisation. Seen some considerable time after the removal of the splints a patient is often found to possess a limb maimed, or deformed, or perhaps useless for

even the lightest work ; and that after protracted treatment with liniments and other altogether inadequate remedies, often including so-called massage. A fortnight or three weeks of skilled treatment may suffice for the restoration of the more fortunate cases, but the majority require anything from six to twelve weeks, or even longer ; while not a few prove to be hopelessly incurable after receiving all possible skill and attention for months.

There is no more pitiable spectacle than that presented by patients in the Physical Exercise Department of a large hospital, and it has done more than anything else to convince me of the urgent necessity of a radical change in the hitherto recognised treatment of fractures.

My afternoons have been mainly occupied in watching the progress of cases of the kind just described in such a department at St. Thomas's Hospital, and I have naturally endeavoured to ensure that my morning patients should not be discharged in that state of physical incapacity to the remedy of which, in other cases, my afternoons have been devoted. Before joining the Physical Exercise Department in an official capacity, I habitually sent my morning cases there as soon as I could do no more for them, if cure was not complete. Since joining the

Department I have treated them myself. In either case treatment has been continued until the "hygienic toilette" already mentioned has been completed and the patients able to return to their daily work, whatever its nature.

Since I have had the opportunity of completing treatment myself the last note made on a case has frequently been "full use, only lacks strength." This is followed a week or more later by "has not appeared since." Such is the termination of fully half these cases, the indication being that the patients' recovery, in *their* opinion, has been more complete than, in *my* opinion, it should have been. I always urge patients to report in a few weeks' time after cessation of treatment, and encourage them to do so still later. Not one in twenty, I should say, has availed himself of the latter offer, though many have reported themselves once. When it has been a question of heavy labour, I have always tried to arrange that patients should resume work on trial only, and should return for further treatment if the strain proved too great. The number of those who have returned for further treatment is very small.<sup>1</sup>

<sup>1</sup> It should be mentioned that, as a result of the Employers' Liability Act, it has not been possible to provide for further treatment (if required) as often as I could have wished. Many works refuse to employ a man until a certificate is produced

I may perhaps, then, be allowed to assume that the outcome of treatment in cases reported in my notes as "cured" has been as satisfactory to the patient as to myself; but it has seemed necessary, in order to set out my results with all possible accuracy, to divide the cases into three classes, viz., children under twelve, women, and men; inasmuch as a woman will have regained the physical power for type-writing before a man has recovered his ability to wield a sixteen-pound hammer for many hours a day after sustaining a similar fracture. Yet the woman may justly be considered "cured."

The expression "returned to work" may be taken as implying that the patient resumed full work immediately after discharge or after the date of the last note made on the case; and as most of my male patients have required certificates before resuming the estimated result and duration of treatment quoted later on may be said to rest on a tolerably sure foundation.

As regards the amount of permanent deformity that may persist after fracture it must be remembered that all fractures of bones which

stating that the patient "is able to resume his occupation" definitely and finally. Thus many patients have been compelled to continue treatment with exercises longer than has appeared to be absolutely necessary. It is possible, therefore, that some of the estimates given later err on the side of precaution.

are sub-cutaneous, *e.g.*, the Clavicle, must of necessity show such deformity owing to the formation of callus, no matter how slight. Hence, in many cases which show a slight degree of deformity on discharge there is a fair presumption that ultimate deformity will be invisible. The excess of callus undergoes a process of absorption which cannot be considered complete for two years. It may be rapid at first, but the final stages of the process are very slow.

Professor Lucas-Championnière refers to "the cicatricial contraction of callus" in many of his writings. No other author does so, although many references may be found to "the absorption of callus." With this I am familiar. Possibly the two expressions have the same meaning ; if not, "the cicatricial contraction of callus" is outside my experience.<sup>1</sup>

<sup>1</sup> On reading this portion of the MS. the Professor inserted a note to the effect that the terms were almost synonymous ; but that the "absorption" was generally held to indicate merely that any excess of callus was absorbed, whereas, in reality, even the callus that actually serves to unite the fragments undergoes a certain amount of shrinkage. As an example he quoted fractures through the lowest inch of the Radius where no alteration can be detected in the relative positions of the two styloid processes at the time of fracture. He tells me that, if these cases are examined a few years later, not only can a groove be felt at the site of the fracture but the Radial styloid is raised to a comparatively high level owing to the "cicatricial contraction" of the callus. I have never observed this phenomenon because, not realising its existence, I have never looked for it.

## CHAPTER XVI

### TREATMENT OF INDIVIDUAL FRACTURES

I HAVE elected to follow Professor Lucas-Championnière's example in respect of the order in which the various fractures are considered. It seems more convenient to consider those fractures first which are encountered in the greatest numbers ; since much that will be said about treatment applies equally to several varieties, and it is undesirable to invest comparatively rare fractures with an importance that belongs to those which occur with greater frequency. The first place, therefore, has been allotted to the consideration of fractures of the upper extremity, fracture through the lowest inch of the Radius claiming precedence.

#### FRACTURES OF THE RADIUS

##### *A. THROUGH THE LOWEST INCH*

###### *General Considerations*

The use of the expression “Colles’ Fracture” is purposely avoided because it implies that

fracture through the lowest inch of the Radius has been accompanied by a certain typical displacement of the lower fragment. There is no valid reason why fractures which present such displacement should be considered as a class by themselves, and it has seemed preferable to group these cases under three headings, viz. :

- (i) All fractures through the lowest inch of the bone, except
- (ii) Separation of the lower epiphysis, and
- (iii) a short series of "occupation fractures" grouped together under the heading of "back-fire fractures."

To prevent misunderstanding it is necessary to point out that, although free use is made of the term "separation of epiphysis," such separation in any position is rare ; so rare, in fact, that it is probable that the only position in which it actually occurs is at the head of the Femur—whence the condition known as Coxa Vara. I have never seen a skiagram which shows true separation in any other situation, but "separation of the (lower) epiphysis" is a convenient phrase by which to describe the position of a fracture the line of which passes through the shaft of a bone in close proximity to, often involving a portion of, the epiphysial line.

Let us now consider the fractures comprised in the first group, referring incidentally to those included in the other two groups.

Much ingenuity has been expended by various writers in explaining the exact displacement that occurs in a Colles' fracture, and the various mechanical laws in obedience to which the displacement has been produced. More useful service would possibly have been performed had the time spent upon theory been devoted to the study of the clinical features. The usual description of a Colles' fracture would lead to the supposition that the displacement is invariable ; but such a conception is misleading, and tends to the substitution of routine treatment for the treatment of each case on its own merits. No two cases exhibit exactly similar displacement, still less similar injury to the soft structures—a point of far greater importance. It will be enough, therefore, to say that the usual displacement of the lower fragment is backwards. With this is combined a certain amount of rotatory movement, the joint surface being tilted backwards and outwards to a varying extent. As a rule the lower fragment is shifted bodily backwards : if far enough to overlap the upper fragment it is then carried upwards ; while failing this freedom of movement, and it

is uncommon, some degree of impaction takes place, often accompanied by comminution. The lower fragment is usually displaced slightly outwards as well as backwards.

It seems idle to try to dogmatise further. Of necessity the displacement must vary with the countless varieties of accident. To find proof of this we need only note, in contrast, two of the more common causes of fracture. A woman who slips on a piece of banana skin not uncommonly "sits down" with her arm at right angles to the pavement; whereas a man who descends from a moving vehicle on to a slippery piece of road is "thrown sprawling on to his face," his arm striking the ground at an angle of perhaps thirty to forty-five degrees. In the former case there will be impaction with comminution and spreading of the fragments, but little or no displacement; in the latter there will be a single sharp line fracture, but the lower fragment may be carried right back on to the dorsal aspect of the lower end of the upper fragment. To class two such cases together, and prescribe similar treatment, seems to be no less absurd than to do so with two cases of appendicitis, the one mild inflammatory, the other fulminating.

It may not be out of place at this point to

consider as a whole the result of falls on to the outstretched hand at the various periods of life. Little attention is given to the subject in the literature, but it is of undoubted value in diagnosis. The following brief summary will be found to furnish a fairly reliable estimate of the injury which may be anticipated at various ages :

- (i) From the time a child begins to crawl about to the age of three fracture of the Clavicle is most common, though the Radius and Ulna may occasionally yield instead.
- (ii) From three to ten is the age at which nearly every case of separation of the lower epiphysis of the Humerus takes place. For this reason it is supposed that children of this age usually sustain such fracture as the result of a fall. This is not the case. The most common fracture at this age is that of both Radius and Ulna ; while even fracture of the Clavicle is of more frequent occurrence than separation of the lower epiphysis of the Humerus as the result of falling down.
- (iii) Between the ages of eleven and seventeen occurs almost every case of

separation of the lower epiphysis of the Radius. Fractures of the Clavicle are becoming fewer in number, while fractures of the Radius and Ulna rapidly decrease in number as the result of falls.

- (iv) About the age of sixteen fractures of Humerus, particularly of the shaft, begin to obtrude themselves, and continue to be met with up to about the age of forty. The surgical neck does not seem to suffer till a later date.
- (v) From twenty to forty, fractures of the Radius and Ulna seem to result most frequently, while fractures of the Clavicle again increase in frequency when the age of thirty is reached.
- (vi) From the age of forty onwards fractures of the lowest inch of the Radius become progressively more numerous than any other form of fracture, although
- (vii) Fracture of the surgical neck of the Humerus becomes frequent enough at the age of fifty and upwards to merit some attention.

We see, then, that the lowest inch of the Radius is liable to suffer fracture at two definite periods of life, viz., eleven to seventeen, and

after forty. Occurring at other ages it is a fair presumption that the cause of the accident was not a fall.

The bony deformity has been described in sufficient detail, but it is necessary to add that separation of the epiphysis, while usually leading to marked deformity, is of such a nature that restitution of the shape of the bone approaches perfection more nearly than in any other form of fracture. Severe "back-fire" fractures seem to give rise to great comminution or great displacement indifferently.

Comminution of the lower fragment is of frequent occurrence and, inasmuch as the fissures often involve the joint surface, great importance has been attached to the recognition of such a condition. Breaking up of the joint surface may lead to subsequent arthritic trouble: my experience is too recent to allow me to advance a confident opinion on the point, though I believe that treatment by massage and mobilisation will be found to limit the incidence of this grave sequel very considerably. As regards immediate treatment and prognosis, fissures into a joint are of no moment. Functional utility and strength may be restored with equal rapidity whether the joint surface is broken or not; it always suffers injury, and the presence

of a fissure seems in no way to aggravate its importance. Whether this is true of cases treated by immobilisation is very doubtful ; with such treatment, involvement of the joint surface may well be a serious matter enough.

Impaction is the third condition of the lower fragment which requires notice. A storm of dissent has been aroused by Professor Lucas-Championnière's teaching that impaction should be regarded as a first stage of repair, and, as such, should receive no correction. This dissent has a double foundation : first, that gross deformity should never be neglected, and, secondly, that any form of disability resulting from fracture is due to bony deformity. A detailed study of the Professor's writings reveals that nowhere has he said that impaction must *always* be respected. His statements on the point are invariably qualified. Thus in "Traitem-  
ment des fractures" (p. 24), "*Certain deformi-  
ties which do not involve angular deformity or  
alteration of axis*" are to be left alone ; "be there  
impaction or comminution, the function of the  
limb loses nothing, and in attempting a reduc-  
tion obstacles to repair are introduced without  
affording any corresponding benefit." Again, in  
an article published in the "Journal de Médecine  
et de Chirurgie Pratiques," Feb., 1908, he

says: "Impaction of the fragments may be considered as the beginning of convalescence. . . . *Where there is no interference with movement* the duty of the surgeon is to leave the impaction. This is a law in the treatment of fractures which is not sufficiently respected." He does not say that no impaction is to be reduced. In addition it should be noted that the last statement occurs during his consideration of a group of fractures characterised by a *slight* degree of deformity.

The only satisfactory classification of fractures through the lowest inch of the Radius is based, as in the article just quoted, on the amount of deformity present. All the fractures then fall under one of three headings:—

- (i) Where deformity is absent, and no alteration has occurred in the relative position of the two styloid processes;
- (ii) Where this relative position has undergone slight alteration, and general deformity is slight;
- (iii) Where there is gross deformity.

The rule as to impaction and comminution in these fractures is:—

- (i) No displacement, comminution frequent;

- (ii) Slight displacement, impaction the rule, comminution usual ;
- (iii) Great displacement, no impaction, comminution rare.

Hence it becomes evident that if there is impaction there can be but little deformity to be reduced. Exceptions are seen, particularly with separation of the lower epiphysis ; and should there be impaction with any but slight deformity, it must be reduced.

If, on the other hand, impaction is present with little or no deformity, there is no fear of displacement, a greater freedom of mobility can be allowed, and treatment may be advanced more rapidly. What useful purpose is served by so loosening the lower fragment that precautions become necessary to avoid risk of displacement, it is hard to perceive ; unless, indeed, it be that the callus formation is less perfect when there is absolute fixation of the fragments than when movement between the fragments is possible. This disadvantage is compensated by the greater freedom with which massage and mobilisation may be performed.

The injury to bone in these cases has been dealt with at some length because it seemed necessary to discuss the various points raised,

not on account of the importance of the actual fracture. This is quite insignificant as compared to the injury done to the soft parts. Bony union is invariable : bony deformity, unless very marked, does not diminish functional utility. But if similar injury be done to the soft parts, in the absence of bony injury, functional disability follows no less surely than if fracture had taken place ; with this exception, that the movement of the fragments augments such injury, and doubtless not infrequently leads to actual tearing.

Let us, then, being confident that the fragments will unite readily and quickly, leave the bony injury and consider the injury to the soft structures, namely the joint, the ligaments, and the tendons.

The wrist-joint always suffers to some extent from a traumatic arthritis. The extent may be gauged by examination of the dorsal aspect of the joint. The extensor tendons suffer a marked teno-synovitis, but the swelling thus formed is quite distinct from that due to the arthritis. The presence of marked swelling over the dorsal aspect of the joint is of great importance to prognosis ; the greater the swelling the more prolonged will be convalescence. It is essential in using this condition for prognostic purposes

to remember the position of the joint, and to distinguish the swelling due to the arthritis from the general œdema, the swollen tendon-sheaths, and the swelling caused by bony displacement. With experience this is a matter of no great difficulty.

It is impossible to gather very much as to the amount of injury done to the ligaments, though presumably it is not great except as regards the internal lateral ligament of the wrist-joint and the inferior and posterior radio-ulnar ligaments. The last two, together with the joint, must suffer considerably in cases where there is any displacement ; which consideration may account for the fact that rotation is much less readily restored in some cases than in others, and explain the marked variations to be observed in the degree of painless rotation possible at the close of the first week of treatment. At the same time, unfortunately, there is no means of detecting the extent of such injury prior to its demonstration by the lack of rotation when treatment is well advanced.

The internal lateral ligament of the wrist-joint always suffers severely. The degree of injury is readily estimated by the length of time that elapses before pain yields to massage. Pain in this ligament is dispelled with difficulty : it is

always the last point at which pain is felt, and the pain may continue long after the restoration of full movement. The nature of this pain merits consideration, because its intensity varies directly with the amount of original displacement of the lower fragment of the Radius. It affords, therefore, a fairly reliable guide in estimating the condition present before reduction, where this has been practised. Fracture of the styloid process of the Ulna is of slight importance except as a certain indication that the strain on the lateral ligament has been excessive, a condition which necessitates prolonged and careful treatment even should the process be intact. When the small fragment has undergone great displacement the appearance, as seen in a radiograph, would lead one to fear endless trouble, which, however, seldom follows.

As already mentioned, the extensor tendons may develop a teno-synovitis : it is often severe, but of little moment as compared with the extensive trouble which is invariably found in the flexor tendon-sheaths. Attention must be drawn to one important point. Very occasionally a prominent band will be noticed running diagonally across the back of the wrist. This indicates an intense synovitis of the extensor longus pollicis tendon. Whenever this band is

seen, convalescence will be slow. It is an inexplicable phenomenon, though the obliquity of the groove on the dorsum of the Radius has doubtless some bearing on it. It seems extraordinary that a single tendon should thus suffer more intensely than its fellows, and that its involvement should indicate severity of injury, but so it is.

The flexor tendon-sheaths are always involved, teno-synovitis occurring to greater or less extent in all cases. On the degree of involvement depends the mobility of the fingers. If it is only slight, movement of the fingers will be tolerably free, voluntary movement being possible : if it is severe, the fingers will be found to be in a position of semi-flexion from which it is impossible to move them without causing severe pain. However rigid they may appear, massage will enable the practitioner to restore slight movement in the course of a few minutes, and a certain degree of voluntary movement is an almost invariable sequel. The fixation of the fingers in flexion has nothing whatever to do with the bony deformity, unless the latter is very pronounced. The fixation may occur when deformity, if it ever existed, has been reduced ; and conversely, perfect mobility may be restored where great bony deformity persists. It is for

this reason that the injury to the bone is of secondary importance. In only two cases have I encountered tendon insufficiency, and in both recovery was complete.

Although it is possible to get some idea of the gravity of the accident from the amount of teno-synovitis present on the palmar aspect of the wrist and from the rapidity with which movement is restored to the fingers, there is no clue to assist a prognosis. The most intense teno-synovitis in this position may vanish with amazing rapidity and fail to retard convalescence. This also applies to any general swelling that may be present. In arriving at a prognosis, therefore, it is wise to base conclusions on the condition found on the dorsal aspect of the limb. One case, already quoted, will serve to show how prognosis is formed. The patient was a chauffeur ; he had sustained a greatly comminuted fracture, the articular surface of the Radius being much broken up, and there being considerable spreading of the fragments. When first seen the arm was swollen to a considerable distance above the elbow, the fingers were rigidly flexed and there was enormous swelling over the flexor tendons. In the absence of any additional swelling over the joint-line on the dorsal aspect of the wrist and of prominence over the course

of the extensor longus pollicis, he was told that he should return to work in six weeks. The prognosis was fully justified : he returned to full work in thirty-eight days, the discolouration of the skin being still visible.

The cause of the traumatic arthritis is obvious, but it is a little difficult to account for the tenosynovitis which occurs on the palmar aspect, even in the absence of displacement of the fragments. The general swelling is, as we have seen, vaso-motor in origin.

There are two types of fracture through the lowest inch of the Radius which admit of perfect restoration of the shape of the bone, namely separation of the epiphysis and those rare cases in which the lower fragment is freely mobile. In all other cases it must be remembered that perfection is unattainable, and also that bony deformity, even though considerable, may in no way lessen the functional utility of the limb.

Why a more perfect restoration of the shape of the bone cannot be achieved it is hard to say. The only plausible explanation is that the edges of the fractured surfaces are serrated, and that these edges are themselves injured, some of the "teeth" being broken. There is a second possible explanation, namely that fracture has

taken place at the junction of the epiphysis and diaphysis, the junction, that is, of the spongy and the cancellous tissue. The form of fracture is, however, so very variable that it is impossible that this line of junction should be involved in all cases ; and even where it is so involved, the bare fact is not an altogether satisfactory explanation of imperfect restoration.

Where slight deformity only exists, perfect restoration being impossible, the alteration which can be effected by the most vigorous manipulation is too insignificant to be of any real service to the patient. It must be remembered that the manipulation lays great strain upon ligaments, and possibly on tendons, which have already undergone severe injury, a drawback only to be justified by great consequent advantage.

If there is any gross displacement, or if it is manifest that the lower fragment has undergone rotation backwards to a marked degree, it is the duty of the practitioner to correct the deformity. Enough has been said of the deceptive “pseudo-deformity.” In default of wide experience the only safeguard is the use of the X-rays. The man who proposes to reduce a trivial bony deformity, no matter how greatly it may be exaggerated by extraneous considerations, is taking on himself a very grave responsibility.

There is but one danger in this doctrine. A certain amount of deformity is usually permanent. If so-called reduction has been practised the deformity is attributed to the severity of the fracture: if no attempt has been made to "set" the bone a similar degree of deformity may be alleged to be due to lack of proper attention. It is necessary, then, during the first visit to warn patients that some deformity will persist. They gaze on the shapeless mass before them in despair: their pleasure at seeing it slowly recover its original form is great, and gratitude for restoration of function is universal. I remember no case where any dissatisfaction has been expressed on account of permanent deformity; the disappearance of apparent deformity being all-sufficient.

At the risk of labouring the point that slight bony deformity is of secondary importance as compared to the concomitant injury to the surrounding tissues, a case reported in detail by Professor Lucas-Championnière may be mentioned. The subject was a young man who had sustained a fracture through the lower end of the Radius. The skin was broken and a small piece of bone which projected was removed. Three weeks later the Professor found his patient playing the violin. He told

him he might resume his work as an accountant. His employer sent him to see "one of the most eminent surgeons of the day" before allowing him to return to work. The latter discovered a trivial displacement of the lower fragment and informed the employer that splintage was essential, whereupon the fore-arm was immobilised for a month. No attempt was made to reduce the deformity. Three months later the trifling deformity was still present, the wrist was stiff, the patient could only write with difficulty, and practice on the violin was impossible. "The surgeon," says the Professor, "had succeeded in assuring the employer that he had performed a valuable service for this young man. The patient . . . was not so fully convinced, and could not help regretting the time when he had been able to play his violin with a perfectly supple wrist."

### *Classical Treatment*

Writing in 1875 Timothy Holmes says that "treatment is very often not entirely successful either in restoring the shape of the parts or the movements of the wrist and fingers. . . . It is well to warn the patient of this." He then calls attention to three varieties of splintage, and concludes : "My own impression is that all

methods give a good result in non-impacted fractures which can be and are accurately set at the time of injury, and where the patient is healthy and tractable ; and even when some deformity remains the movements of the wrist and fingers are preserved if timely passive and active movements are insisted on. . . . The joint should not be kept too long stiff ; but after about three weeks it should be taken out of the splints, and careful passive motion be given to each finger-joint and to the wrist, the limb being first well steamed." This eminent surgeon had realised thirty-five years ago the value of what he regarded as "early" passive movement, but seems not to have been aware of the beneficial effects of massage. So he lays some stress on "setting" the bone, and apparently views impaction with apprehension. It is a matter for regret that Mr. Holmes has left no record of what he considered "good results."

Three points call for special attention, according to Cheyne and Burghard, in the treatment of Colles' fracture, by which they appear to mean any fracture near the lower end of the Radius except separation of the epiphysis. "The fracture is commonly impacted and its reduction requires considerable force ; it is most essential that the reduction should be complete."

There is always a “tendency to stiffness due to adhesions in the tendon-sheaths, and, lastly, adhesions will generally occur in the synovial membranes of the wrist.”

Splintage is applied to both aspects of the fore-arm, but the fingers are to be moved daily by the patient as well as by the surgeon. The posterior splint is daily removed on and after the third day for massage, both splints are removed in a week, and the anterior is shortened. Movements of the wrist are commenced. Splints are discarded in eighteen days, a sling being used for another fortnight; the splints, however, are replaced at night.

In *The Manual of Surgery* of Rose and Carless there is a lengthy dissertation on the nature and production of deformity, the instructions on treatment commencing with the words “to reduce the deformity,” implying, presumably, that reduction should always be practised. Four methods of splintage are discussed, and the student is instructed to remove splints in a fortnight, replacing them with leather or gutta-percha support for “some time longer.” The fingers are to be left free and exercised after the first day or two: massage and passive movement should be employed after the first week.

As regards prognosis: “Union is effected

without difficulty, but the patient should always be warned at an early date to expect some deformity about the wrist, as well as considerable impairment in the subsequent mobility of the fingers and hand, owing partly to adhesions in the joint, partly to blood trickling down the tendon-sheaths and fixing the tendons." In an earlier portion of the same chapter there is short reference to treatment by mobilisation and massage, and one statement is made which requires special notice, viz., that "neighbouring joints will also be rubbed, and gentle passive movements undertaken. Possibly some pain will be noticed at first, but it soon disappears and the patient experiences a sense of comfort." If rubbing or movement is a cause of pain the method is abused. The only comment on the success of such treatment is that "it has already proved to be of greatest service."

No guidance is given as to the length of convalescence to be expected or as to the treatment which is advised during convalescence. The prognosis as a whole is, therefore, hardly more satisfactory than that made over thirty years previously.

The *Manual of Surgery* by Thomson and Miles contains the statement that "the periosteum is usually torn and stripped from the palmar

aspects of the fragments (after Colles' fracture) while it remains intact on the dorsum." As a matter of fact the periosteum on the dorsal aspect is rarely, if ever, torn ; and a moment's consideration will show that, if any posterior displacement of the lower fragment has taken place, the sharp anterior edge of the upper fragment must press upon the anterior periosteum. This pressure increases with the increase of deformity, with the result that the periosteum on the anterior aspect is torn completely across whenever there is gross displacement of the lower fragment, but there is little or no stripping. On the dorsal aspect, however, there is no tearing of the periosteum, which remains intact in spite of a most marked posterior displacement of the lower fragment. There can be but one result, namely that the periosteum is stripped from the posterior aspect of the upper fragment to an extent that varies with the amount of displacement.

In speaking of treatment they say : " It cannot be too strongly insisted upon that success in the treatment of Colles' fracture depends chiefly upon complete and accurate reduction. As considerable force may be necessary, especially where impaction exists, a general anæsthetic is of great assistance," thus implying

that the fragments should be disimpacted as part of routine treatment.

No distinction is made by these authors among cases presenting varying degrees of mobility of the lower fragment, since they state that "there is no tendency to redisplacement." They recommend a flannel bandage, adhesive plaster or poroplastic wristlets as efficient splints, the use of more rigorous splintage being restricted to certain unspecified cases. Massage should be commenced "within the first few days;" and splints, if used, are discarded in a week or ten days. They regard all special splints as having been designed to correct deformity, and therefore condemn them as useless. They seem, however, to have overlooked the fact that a Carr's splint affords a far greater sense of comfort to the patient than any other form of fore-arm splint, and may be used with advantage in spite of being useless for the purpose originally intended by the inventor.

#### *Massage Treatment*

The patient comes to the medical man with the hand pronated and the fingers flexed. It is the "dinner-fork" deformity, and movement is impaired or impossible. This deformity is not diagnostic: it may be caused by any injury

which has set up a teno-synovitis of the tendons on both aspects of the wrist. No displacement of the lower fragment is necessary, the appearance being mainly due to the swelling of the tendon-sheaths having been limited by the inelasticity of the annular ligaments.

As a rule, either a single glance will suffice to make a correct diagnosis, or prolonged and careful examination will be necessary. In the latter contingency, in order to arrive at a correct diagnosis massage is almost indispensable. In a few minutes pain will be so diminished that examination will cause little distress. If there is fracture without displacement, gentle pressure on the outer border of the Radius an inch or so above the styloid process will reveal a point of exquisite tenderness ; in the absence of fracture such a point does not exist, though, should pain be more marked at one spot than another, it will be on the back of the wrist an inch or more nearer the hand. If doubt still exists great tenderness over the tip of the styloid process of the Ulna will confirm the diagnosis of fracture, whether the process be broken or intact.

If deformity is present the Radial styloid process will be found to occupy a relatively higher position than before fracture when compared

with the corresponding process of the Ulna. This is diagnostic.

A crucial point now arises. Is any attempt to be made to reduce deformity ? Before doing so the extent of bony displacement should be examined by the X-rays unless there is *free* mobility of the lower fragment. In this case reduction may be practised safely and at once. In the absence of facilities for the use of the X-rays the safest rule is to attempt reduction only if mobility can be demonstrated with ease.

The usual method of reduction is to administer gas, pull violently on the hand and bandage two splints firmly on to the fore-arm before anæsthesia has passed off.

The anæsthetic is administered to prevent pain : no account is taken of the subsequent pain which is the more intense by reason of the violence with which the manipulations have been performed in order to save time. The splints are applied too rapidly, and therefore, as a rule, too tightly ; and, lastly, the patient is apt to undo any good which may have been done by struggling on recovery from the anæsthetic.

If there is no impaction, that is to say in the majority of cases needing reduction, the administration of an anæsthetic may be unnecessary. The method of reduction should be as follows,

the fracture being, for example, in the right fore-arm. The practitioner sits down facing the patient, whose knee is opposite the front edge of the seat of his chair. He crosses his right leg over the left and rests the fore-arm on his right thigh. He then grasps the patient's hand in his



FIG. 30.

Reduction of a fracture through the lowest inch of the Radius.

right hand, as if they were going to shake hands, and gently strokes the whole of the fore-arm upwards with his left hand about fifteen times a minute (see Fig. 30). In five minutes pain will be greatly relieved, and the next five minutes are occupied in slowly moving the two interlocked right hands in the direction of the operator's left hip-joint. A third five minutes are

occupied in continuing this movement and, at the same time, slowly flexing the patient's wrist. The left hand performs its work with unvarying regularity, and so relieves the pain that it is amazing how great may be the traction exercised



FIG. 31.

Another position for massage of the fore arm. The operator's left hand can exercise a great deal of control over the lower part of the Radius. This is an excellent position for massage of those cases where there has been free mobility of the lowest inch of the bone.

by the operator without causing any distress. In a quarter of an hour the deformity is reduced, and a final five minutes may be spent in relieving any lingering pain. When reduction has been effected a change of position may be made to that shown in Fig. 31. Many deformities will

be found to reduce quite readily by this method, but if it fails, or if the fracture is impacted, an anæsthetic is required. In this event open ether or C.E. mixture should, if possible, be chosen, in order that reduction may be carried out gently and with deliberation, and also with a view to massage being performed for at least a quarter of an hour before the application of splints and while the patient is still unconscious.

The success of reduction depends upon the length of time that has elapsed since fracture. After about six hours every additional hour renders reduction less simple, and at the end of twenty-four hours hope of attaining a good result has become infinitesimal. In the three consecutive years, 1895, 1896, and 1897, three surgeons of great eminence expressed, in the *Lancet*, different views on the subject of the reduction of fractures as a whole. Marmaduke Sheild refers to "the folly of attempting at once to fix a bad fracture in accurate position," and suggests a delay of several days. Christopher Heath recommends delay "of a few hours," while Pearce Gould says emphatically that "the reduction of the fragments must be complete and perfect at once." The last is the only proper advice in cases of fracture through the lowest inch of the Radius, unless time is needed

to prepare for a general anæsthetic, in which case the delay should be as brief as possible.

Reduction having been completed, or rejected as unnecessary, and massage continued in either case until pain has been relieved, or, if the patient has been anæsthetised, until there is no fear of renewal of pain with the return of consciousness, a dose of mobilisation must be administered.

It is usual to find that patients essay some small voluntary movement as the pain wears off, but massage must be continued until the patient admits relief. It will occupy about ten minutes, and will consist of the lightest possible stroking. If reduction has been performed an extra five minutes may be required before commencing the mobilisation. Even if the reduction has been performed under an anæsthetic the mobilisation must not be omitted.

In all cases alike the dose administered should be very small, and massage should be continued throughout the administration. The wrist may be flexed through some  $10^{\circ}$ - $15^{\circ}$  at a rate of ten times per minute, the movement being interspersed with minute doses of adduction and abduction, either separately or in combination. Each finger receives a minute dose of flexion and extension, the whole occupying five minutes.

A return to general massage without the movements terminates the *séance*. Local treatment may be postponed.

But although movements of this small amplitude are advocated, it must not be forgotten that the joint surface is very often involved in the fracture. If this is the case, or if there is reason to suppose that it is so, the dose of mobilisation must be increased as regards the amplitude of the movements. Full movement in any direction is not called for ; but flexion and extension, adduction and abduction, must be performed painlessly to the limits allowed by the injured tendons and other structures. This is done to ensure the fragments which bear any portion of the joint surface being replaced, so as to render the joint surface as smooth as possible. On the second day the small amplitude will quite suffice, and, though this is gradually increased each day, the increase is so slight that several days must pass before the amplitude of movement attained on the first day is again reached.

The question of splintage must now be considered.

“ I never advise,” says Professor Lucas-Championnière in an article published in the *Journal de Médecine et de Chirurgie*

*pratiques* of February, 1908, "that splints should not be applied." This advice differs widely from that given in his larger work, in which he says (page 201) that "except in rare cases . . . I apply no contrivance other than a flannel bandage." This is also the teaching of Dr. Dagron.

The two statements are not consistent; but it will be observed that they were written at different periods, thirteen years having passed between the publication of the book and of the article. In practice, opportunity is presented for so wide a variance as regards detail that both methods of treatment are applicable.

Enthusiasm may lead the practitioner to run unnecessary risks, and there is much force in the Professor's reasoning (in the article quoted) when he says that "a patient will pay no attention to instructions if not fettered to some form of splint." This can only mean that the use of splints may often be advisable when from the nature of the fracture it is not imperative.

In the absence of mobility and bony deformity I was formerly accustomed to relinquish the use of splints at once, in accordance with what I understood to be the Professor's teaching and with the greatest benefit to my patients. Some months elapsed before I realised that good for-

tune alone had saved me from disaster. Then I came upon an old woman who attempted to make her bed within a few days of sustaining a fracture that had presented gross displacement before reduction. On reflection several cases came to mind in which progress up to a certain point had been most satisfactory, but in which untoward symptoms had rather unaccountably presented themselves. The patients as a rule attributed their troubles to rheumatism, but there is little doubt that the "rheumatism" was only a handy inexactitude. So many aged patients who sustain a fracture through the lowest inch of the Radius are afflicted with somewhat indefinite joint pains, greatly increased by direct injury and also indirectly by shock, that it is difficult to discriminate between these pains and others due to injudicious use.

But, though disaster did not come upon the cases in which the use of splints was discarded from the outset, it has twice visited my treatment of other cases. On those occasions the lower fragment had been freely mobile. I may plead, in extenuation, that I did not see either case until many hours after reduction and the application of the splints, and so had no indication that there was danger. In one case deformity had failed to reduce, as shown by

X-ray examination immediately after setting. Under the circumstances it may well be that the treatment received restored to the wrist a maximum degree of functional utility. In the other case, however, restoration had been perfect, and splints were discarded on the third day. The only consolation was to find, on X-ray examination after the return of the deformity, that there was impaction of the fragments, indicating that the patient had suffered further injury, though no confirmation could be obtained. However, the treatment must be held responsible, since the accident, and therefore the deformity, might never have occurred had the use of splints been continued for a longer period.

In considering the question of splintage there are various factors to be taken into account. In a few cases of fractures of the first two classes, where bony displacement is absent or slight, and no reduction is called for, a simple flannel bandage may suffice. But it is a risky expedient in hospital out-patient practice, as it is in that of any private patient who cannot be relied upon to carry out instructions implicitly.

In all cases outside the above classes the use of splints is imperative. The most suitable will be found to be Carr's splints (which include a posterior straight splint). Both must be well

padded, and the bandages must not be applied tightly, only just so tightly, in fact, as to prevent any shifting of position for twenty-four hours. It must be remembered that the use of splints in these cases is merely precautionary : the splint,



FIG. 32.

Showing Carr's splints applied to the fore-arm, and correct application of a sling. Note that the cross-piece of the anterior splint is not resting on the sling, and compare the general position of the limb with that shown in Fig. 33.

however, often gives a feeling of security, and provides the patient with something firm by which the injured arm may be raised and moved without pain.

Webbing with buckles is often preferable to bandages. The dorsal splint should extend to

the knuckles and should be longer than the anterior splint (see Fig. 32).

The patient will be most at ease if the sleeve of every article of clothing is slit down the seam of the arm from top to bottom. This allows



FIG. 33.

A very usual and improper position of the fore-arm when supported by a sling.  
The insertion of a safety-pin, as in Fig. 32, is all that is required.

him to be fully dressed and enables the practitioner to administer a daily dose of massage to the upper arm. It also enables him the more readily to mobilise elbow and shoulder, a part of treatment on no account to be overlooked.

The arm must be supported by a linen sling in the position shown in Fig. 32.

The most suitable division of these fractures into three classes has been mentioned. In the first two, where bony displacement is absent or slight, the splints are removed daily for massage, the fingers receive individual attention, and all movements which cause no pain are



FIG. 34.

performed. Dorsi-flexion of the wrist should be prohibited for a week.

Rotation may be commenced on the second day, but with extreme care, increasing daily up to fifty per cent. by the end of a week.

Movement of each finger must be performed in a special manner. The metacarpo-phalangeal joint is first fully flexed, the other joints being more or less extended. The flexion of the

proximal joint is then relaxed while the middle joint is fully flexed, this again is relaxed while



FIG. 35.



Fig. 36.

Three stages in the administration of a full dose of mobilisation to the little finger.

the terminal joint is fully flexed (see Figs. 34, 35 and 36). Movements of adduction and

abduction conclude the treatment. The fulness of the movement must, of course, be attained by gradual stages.

On the second day patients are advised to practise “five-finger exercises” slowly and frequently, but only for a minute at a time ; the next day they should try rolling balls of paper between the thumb and each finger in turn. At the end of a week writing exercises are prescribed in suitable cases.

The posterior splint may be omitted on the second or third day, but the anterior should not be abandoned till the end of a week or ten days according to the class of fracture.

On the second day of treatment of fractures of the first two classes, and after the removal of the second splint in the case of fractures of the third class, local massage may be begun. This consists of massaging the neighbourhood of the wrist joint with the two thumbs. The point requiring most attention is the internal lateral ligament (see Fig. 19, p. 148). For the rest it is well to treat the various tendon-sheaths individually, to which end it may be advisable to commence the local treatment at the finger-tips and carry the movements to a point about three inches above the level of the head of the Ulna. This is most suitably effected

by splitting the movements into three, each finger receiving its individual dose, then the region of the hand, and, lastly, the region of the ligaments of the wrist, the annular ligaments, and that portion of the fore-arm through which the tendon-sheaths pass. The actual site of fracture must be avoided.

On the removal of the second splint dorsiflexion may be commenced, and exercises of circumduction prescribed, together with knitting, crochet-work and the playing of piano or violin.

It is about this time that a difficulty almost invariably presents itself. Rotation has hitherto been restricted to movements extending from the position of full pronation to a position rather more than mid-way between pronation and supination. The problem is how to achieve the remainder of the supination. A simple and effective method is to apply the massage to the anterior aspect of the limb while withdrawing all support from the posterior aspect on its outer side. The gentlest pressure during the stroking movements will then be found to add an infinitesimal amount of supination every time the massaging hand passes over the lower part of the limb. The movement is so slight as to be imperceptible by practitioner or patient, but

the sum of the movements at the close of five minutes is readily detected, and by the end of three or four days supination will be complete. It is worse than useless to attempt to procure the movement by actually rotating the wrist in any other way ; though, when the movement

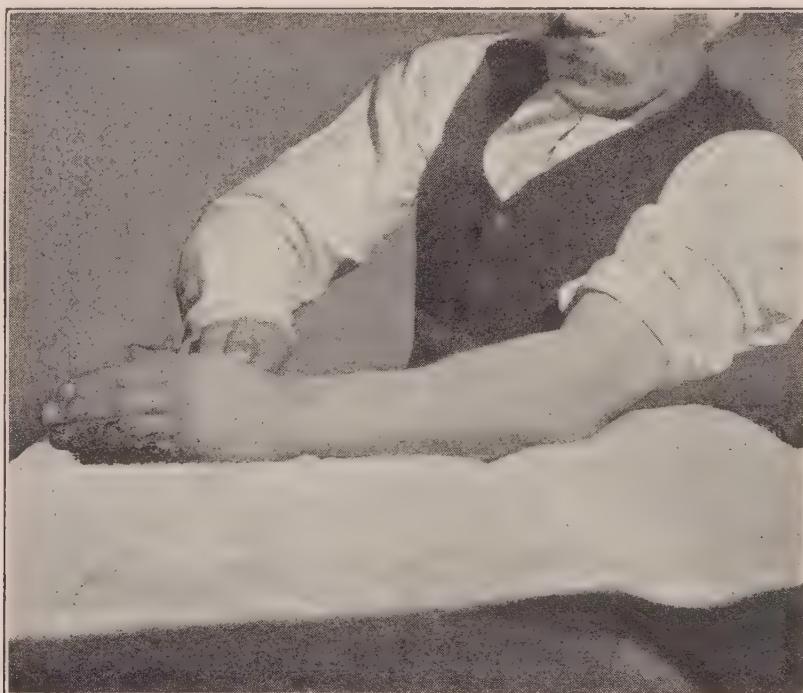


FIG. 37.

An early stage in exercise for obtaining full rotation of wrist.

has once been performed, freedom may be restored by frequent repetition after any manner which may suggest itself. As simple a way as any is for the patient to seat himself at a table and rest thereon the ulnar margin of his one hand, while with the other he rocks it gently backwards and forwards (see Figs. 37 and 38).

The patient may likewise be taught to grasp a

stick in the middle and rotate it, keeping the elbow fixed, day by day shifting the grasp more and more towards one extremity. Turning a door handle is a useful exercise, the sound hand being kept on the other handle to regulate the resistance. At the same time patients are

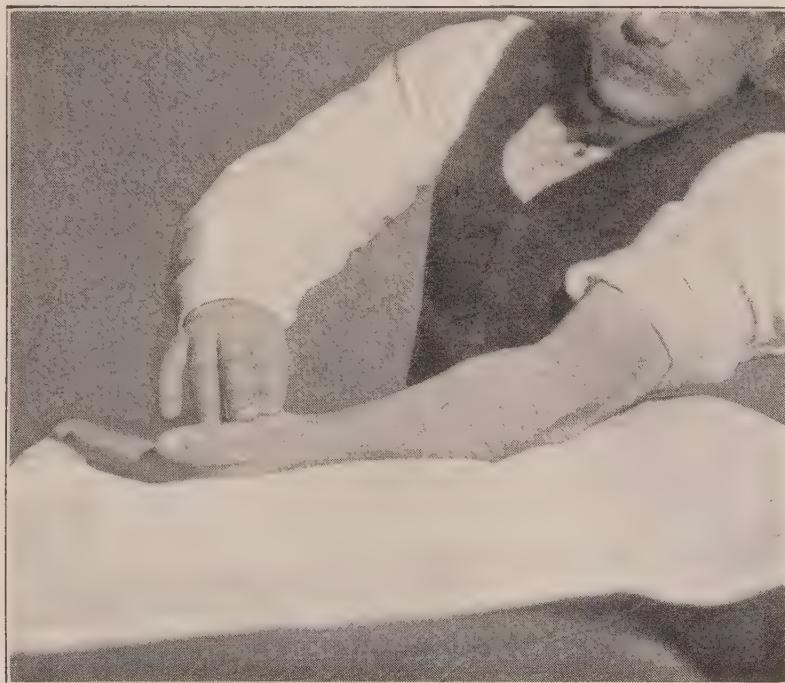


FIG. 38.  
The final stage.

allowed to dress and feed themselves, provided they do not attempt to cut up meat or bread. In three weeks there should be perfect freedom. A woman may often then return to work, a man sometimes, but a "labouring"-man requires at least six weeks to regain full strength. By that time he should be able to perform such work as is commonly known as "general labour."

The effort needed to wield, say, a sixteen-pound hammer may involve an extra two weeks' delay for practice. The best curative treatment possible at the end of four weeks is to resume work, provided always that it is relinquished directly any pain is felt.

Any form of spring-grip or dumb-bell may be used to strengthen the fingers.

As many of these patients are no longer young, it is well to advise that a flannel bandage should be worn for four weeks. They like it "to keep out the cold"; and it serves to remind them that they are still under treatment, and must obey instructions.

Treatment of cases where there is free mobility of the lower fragment should be very different, although, up to the present time, the principle has not been acknowledged in my practice. If the case is seen early enough perfect reduction is the rule, and there is less permanent deformity than in the second class of cases already considered. If, however, the tendency on the part of the muscular spasm to return is not counteracted by massage after reduction, the deformity is very liable to recur after the application of the splints.

As soon as reduction has been performed massage must be continued for twenty minutes if general anæsthesia has proved to be necessary, or for ten if the “anæsthesia of massage” has allowed the reduction. Much then depends on the patient, and Prof. Lucas-Championnière says that if the patient is fidgety or unintelligent a plaster splint should be applied for four days, while in other cases ordinary splintage should be left *in situ* for two days. In the event of any return of pain the contrivance in use must be removed at once, and the limb massaged till pain has ceased. A splint should be worn for three weeks.

Experience leads to the conclusion that removal of the splints before the third day, on account of pain, would be the rule, and the wisest procedure will be found to consist of the removal of the dorsal splint on the first and second days when massage is applied, as far as circumstances will allow, with the fore-arm and hand still supported upon the second splint. On the third day both may be removed, and the use of the dorsal splint may be discontinued after a week, adhesive plaster taking the place of the second splint a week later. Treatment with exercises then proceeds as before. Great service may be rendered to a patient by incomplete

massage while the second splint is still in position, as I know by experience, having adopted this procedure in all my earliest cases.

To summarise the results of treatment, it may be anticipated that full functional utility will be restored for domestic, clerical, and other non-laborious purposes, such as the playing of musical instruments and type-writing, in four weeks and occasionally in three ; in six weeks for ordinary labour ; in eight weeks for work of any kind. If limitation of movement or lack of strength persists at the end of eight weeks' treatment it usually indicates faulty technique, disobedience of the patient, or the presence of some intercurrent disease, probably chronic rheumatism. Even in this last event functional utility should be restored until the injured limb is at least as useful as its fellow. Great perseverance may be wanted, and if the internal lateral ligament has suffered very severely pain over the ulnar styloid may persist in a most disheartening manner. There is only one case in my series in which I failed to give my patient such strength and freedom of movement as to enable her to perform all the ordinary necessities of existence with ease and comfort ; this being the case of an aged woman who had suffered intensely from chronic rheu-

matism for years, and who exhibited a marked degree of Dupuytren's contracture in the injured hand. I have never failed to re-fit a man for his employment, and 95 per cent. of my patients have resumed their normal occupation within eight weeks, almost 50 per cent. within four, and many within three weeks of the date of accident.

The average age of patients who suffer fracture through the lowest inch of the Radius is rather high. As has been said, many of the older patients, and especially the female patients, suffer from more or less chronic pain in all their joints. "The rheumatics," as they call them, are a source of endless trouble. In a few cases the massage may be so beneficial as to induce a greater degree of functional utility after fracture than has been enjoyed for many years. Unfortunately this is not always so, nor is benefit derived so readily after injury to the wrist-joint as when other joints are involved.

Whatever may be the cause—perhaps it is that the bones of the patients who suffer from the "rheumatics" are brittle—these patients always manage to inflict severe injury on the internal lateral ligament, and very frequently to fracture the ulnar styloid. No matter how fully strength may be maintained by treatment, or

how successful we may be in restoring movement, a tendency to chronic joint pains will often cause the patient to suffer in the injured wrist-joint for a considerable period, long after he or she might be pronounced as "cured" in every other respect. Massage will always afford a temporary relief, and perseverance, perhaps for as much as three or even four months, will almost invariably be rewarded by a perfect cure. I have failed twice, the one instance being that already confessed and the other the case of a chronic alcoholic.

One form of fracture through the lowest inch of the Radius requires special notice, viz., fracture of the styloid process. This may occur as a simple fissure, or it may be accompanied by varying degrees of outward dislocation of the wrist-joint. In the latter case all that has been said on the subject of the treatment of the other fractures through the lowest inch of the Radius will be applicable. The fracture should, however, as a general rule be considered as one where free mobility has been present.

In other cases, where there is a simple fissure involving the wrist-joint, the accident is trivial. No splint is required, free use may be allowed from the outset, limited only by the onset of pain, and recovery should be complete in a fort-

night ; though laborious work should not be undertaken for three weeks, or even four in exceptional cases.

As a result of the accident caused by the back-firing of a petrol-engine any variety of fracture may be discovered. As a rule the fractures have one common feature, namely, the separation to some extent of the radial styloid process. It is by no means invariable. The Scaphoid bone is frequently broken at its "waist." There is usually some comminution of the Radius, and it is prudent to reckon most of these cases as of the class of fractures where there is a liability to displacement. The joint-surface is almost invariably broken, but this is of small significance. In a few cases the Radius suffers fracture some two inches above the level of the wrist.

In rare instances the styloid process of the Ulna is broken, and the head of the bone may be comminuted.

The teno-synovitis is always well marked.

I have once seen backward dislocation of all the carpal bones except the semilunar. Ultimately the patient made a good recovery without operation notwithstanding persistent deformity.

Lest it be thought that the duration of convalescence after fracture through the lowest inch of the Radius has been underestimated, I will

quote a recent paper by Dr. de Marbaix, of Anvers, Médecin conseil de la Cie Général Accident, Fire and Life, read before the III<sup>e</sup> Congrès National des Accidents du Travail, 1910. His patients were chiefly dock-labourers who worked in batches, remuneration being made for the work done by each batch and not by the individual. As Dr. de Marbaix points out, the fellow-labourers would take care that no invalid was allowed to form one of their number. Dr. Marbaix performed reduction in none of his cases, in spite of gross deformity being present in many of them. Out of eighteen cases treated by mobilisation and massage (with a maximum delay of seven days) the average duration of treatment was forty-one days, and all returned to full work.

He also quotes two other series of cases. Amongst five cases treated by immobilisation for two months one alone made a complete recovery, the average duration of treatment being 261 days. And, again, amongst sixteen cases treated during 1905, the average duration of treatment was eighty-six days, while 25 per cent. lost the use of their hands completely. The duration of splintage is not specified.

## CHAPTER XVII

### OTHER FRACTURES OF THE RADIUS

THESE consist of :—

- (i) Fractures of the head and neck.
- (ii) Separation of the upper epiphysis.
- (iii) Fracture of the shaft.

The last group is usually sub-divided into :—

- (a) Fractures above the insertion of the pronator radii teres.
- (b) Fractures below that point.

### FRACTURES OF THE HEAD AND NECK

#### SEPARATION OF EPIPHYSIS

*General Considerations.*

These accidents rarely occur alone, and are usually accompanied by other injuries in the form of fracture-dislocations. Fracture of the head alone may be accompanied by backward dislocation of the fore-arm, but, as a rule, other fractures are present, the most common

being supracondylar fracture, fracture of the external condyle of the Humerus, or oblique fracture of the shaft of the Ulna just below the greater sigmoid cavity, and even fracture of the Olecranon.

Two dangers are usually discussed, *viz.*, failure to obtain union and the formation of an excess of callus.

So far as bony injury is concerned these fractures may be considered as trivial, but far otherwise when we consider the injury done to joints and ligaments. The value of early movement is well recognised, but the violence with which it is carried out renders the chance of obtaining bony union very problematical. Moreover the patient is subjected to an exceedingly painful process daily for weeks, ultimate recovery being slow. The failure to obtain bony union in cases of oblique fracture above the orbicular ligament is a matter of no moment, since it does not preclude restoration of perfect functional utility and strength.

#### *Classical Treatment.*

Fractures of the head and neck of the Radius "are rare but of great importance," according to Cheyne and Burghard. Non-operative treatment is not discussed except for separation of

the upper epiphysis. For this they recommend an anterior angular splint with a straight posterior splint for the fore-arm, and passive movement after the first ten or fourteen days.

Rose and Carless urge early passive movement and splintage, with frequent recourse to operation, while massage treatment is recommended by Thomson and Miles. Holmes merely mentions these fractures.

#### *Massage Treatment.*

Any injury to the upper end of the Radius is more than usually painful.

If dislocation is present the deformity will be obvious, but diagnosis of the actual injury to the Radius is very difficult.

Massage must be commenced at once, partly in the almost certain hope that it may render reduction of dislocation not only possible but easy, and partly to allow of careful palpation, by which alone a correct diagnosis is attainable.

In all cases the fore-arm is flexed and pronated: all attempts at supination cause great pain over the head of the bone, and this is also a seat of extreme tenderness. Should sufficient movement be possible after massage, the head of the bone may be found to remain stationary, crepitus may be felt, or some irregu-

larity of bone observed. In fracture of the neck the lower fragment may be pulled forwards into prominence by the biceps. In all cases flexion and extension cause intense pain.

The dislocation, if present, must be reduced by gentle manipulation after massage. If this method fails a prolonged anæsthetic is needed to allow of careful reduction followed by massage before the patient recovers consciousness.

The course of treatment and prognosis are such as in the case of supracondylar fracture of the Humerus. If dislocation has been present, or if the fracture involves the neck of the Radius with displacement of the lower fragment forwards, the case must be considered as in all respects comparable with separation of the lower epiphysis of the Humerus ; in the absence of dislocation all other forms of fracture must receive attention similar to that recommended for supracondylar fracture without displacement.

In either case the only difference in treatment should be that the dose of rotatory movement must at first be very minute, while flexion and extension of the elbow may be advanced rapidly ; the converse being the treatment advocated when the Humerus has suffered injury.

Under such treatment bony union will be

found to be the rule ; excess of callus, in the absence of excess of movement, will rarely, if ever, be formed.

Ultimate recovery will depend entirely on the progress made by the other structures which have suffered injury. In all cases three weeks should suffice to restore functional movement, another week, functional utility, and a further fortnight should find the patient fit for any form of manual labour. In those rare cases where fracture of the head of the Radius is the only injury, three weeks should suffice for complete recovery.

The chief difficulty met with in the course of treatment is to restore the last half of supination. This is effected by the means described under the treatment of fractures through the lowest inch of the Radius.

If, after three days, an X-ray examination reveals persistent displacement, removal of the offending fragment will be indicated ; but this necessity will seldom arise.

#### FRACTURES OF THE SHAFT

##### *Classical Treatment*

Treatment of fractures of the shaft of the Radius is dealt with by Cheyne and Burghard

under two headings : first, if the fracture be above the insertion of the pronator radii teres, and, second, if it be below that point. In the first event an anterior rectangular splint with a posterior fore-arm splint are used for about four weeks with a pad over the lower end of the upper fragment. The fore-arm is maintained in full supination. Passive movements of the elbow, wrist, and fingers are practised from the outset, but rotation is only to be begun when splints are discarded.

In the alternative case the fore-arm is put up at right angles to the arm, midway between pronation and supination. An external angular splint is recommended, but no instructions are given as to the duration of treatment.

The advice given by Rose and Carless, as well as by Thomson and Miles, is identical. Holmes only mentions these fractures, advising that a pad be applied between the two bones.

### *Massage Treatment.*

Diagnosis is, as a rule, very obvious. In all cases the hand is pronated and supination is impossible. The elbow is flexed, and the patient will probably desire to support the injured limb. If the fracture is above the pronator insertion the upper fragment is flexed and supinated and

may be seen or felt projecting forwards, while the lower is adducted and pronated.

If the fracture be lower down, the upper fragment is drawn forwards and inwards, being in the position of semi-pronation, while the lower fragment occupies a similar position to that assumed in the preceding fracture.

If the periosteum is but little injured, as frequently happens, there is no displacement and a certain amount of rotation may be possible. Gross deformity is very exceptional, although the text book description of these fractures would indicate great displacement of the fragments as being the rule.

Certain fractures through the lower third of the shaft frequently present a simple tilting of the lower fragment. An X-ray photograph taken in the antero-posterior position may fail to show any deformity. (See Figs. 28 and 29, p. 213.)

In the absence of obvious displacement pain must be relieved by gentle massage, when a point of acute tenderness on the bone will establish diagnosis.

The usual method of adjusting the position of the lower fragment to suit the position of the upper is rarely satisfactory. Massage alone affords a reasonable hope of re-adjustment of the

deformity with accuracy. It may be urged that it is impossible to massage the supinator brevis and pronator quadratus: but that argument ignores the fact that the effect of massage is reflex. The biceps is the most powerful supinator, the pronator radii teres is a superficial and powerful pronator, and, moreover, the nerve supply of the latter muscle is very similar to that of the pronator quadratus. It is well known that, in the course of normal muscular action, contraction of one muscle is accompanied by contraction of its synergists and by the relaxation of its antagonists. It is safe to conclude, therefore, that relaxation of the spasm of the biceps, pronator radii teres and other less important rotators, resulting from general massage, will lead to a simultaneous relaxation of the spasm of the deep supinator and pronator. This conclusion is fully confirmed clinically.

In the absence of spasm there is no force to disturb the relative position of the fragments provided that they are placed in a position of maximum comfort, the muscles being consequently in a condition of maximum relaxation. This position is found mid-way between pronation and supination with the elbow flexed to slightly less than a right angle (see Fig. 32, p. 264); and it is in this position, therefore,

that all fractures of the fore-arm should rest, if treatment by massage is being applied.

Treatment should commence in all cases with massage of the arm for five minutes, even in the absence of obvious pain and spasm. The fore-arm receives similar attention for ten minutes, the last five being also occupied in gently moulding the displaced fragments into position, and, at the same time, moving the hand from the pronated position into that of maximum comfort and rest. Pain is rarely very severe and is relieved without difficulty.

If at the end of a quarter of an hour the deformity remains, an anæsthetic must be administered and the cause of obstruction investigated. Manipulation will, as a rule, suffice to restore the shape of the bone, when massage must be continued for some ten minutes or more according to the amount of manipulation required. As regards splintage, an internal angular splint will be found most satisfactory.

For the first week mobilisation should be confined to flexion and extension of the elbow, commencing with movement through not more than  $10^{\circ}$ , and increasing to some  $90^{\circ}$  by the end of the week. Free movement of the wrist, except rotation, may be practised daily, and free movements of the fingers are allowed throughout.

During the second week rotation should be slowly advanced until it is nearly or quite complete ; full play may be allowed to the elbow, massage of the arm is abandoned and the internal angular splint is replaced by a long posterior splint, extending from the knuckles to the elbow. The patient is allowed to dress and use the fingers.

The splint is discarded at the beginning of the third week, amplitude of movement is restored and gentle use allowed. Any exercises that may be required for the restoration of strength are prescribed during the fourth week ; but such freedom may be allowed during the third week that little subsequent treatment should be necessary.

If there is no deformity a splint is unnecessary. Rotation may be commenced at once and the patient is fully dressed, a few gentle exercises being prescribed. Light use is made of the hand from the beginning of the second week, and restoration should be complete in three weeks.

Children require careful treatment. It is wise, as a rule, to adhere to the use of a splint and to prohibit all use for three weeks.

General massage is all that will be required, unless local treatment is called for to aid the removal of localised swelling.

Occasionally severe traumatism of other structures is present. The styloid process of the Ulna may be separated even in case of fracture of the Radius some three inches above the wrist-joint. These cases require treatment on the lines advocated for the treatment of fractures through the lowest inch of the bone, with such slight modification as may appear necessary, treatment of the injury to the wrist-joint being of the first importance.

## CHAPTER XVIII

### FRACTURES OF THE ULNA

THESE consist of :—

- (i) Fracture of the Olecranon.
- (ii) Fracture of the Coronoid.
- (iii) Oblique fracture of the shaft  
below the lesser sigmoid cavity.
- (iv) Fractures of the shaft.
- (v) Fractures of the head.
- (vi) Separation of lower epiphysis.
- (vii) Fracture of the Styloid process.

Fracture of the Coronoid process is always accompanied by backward dislocation of the fore-arm. It will be found amenable to the treatment prescribed for supra-condylar fracture of the Humerus with displacement. No variations in treatment are necessary, and the prognosis is similar in all respects. Cases may occur in which operation is called for, but massage and movements will, as a general rule, afford a perfect recovery.

Oblique fracture below the lesser sigmoid cavity will be found to fall under one of these heads ; it may present all the features of fracture of the Olecranon ; it may be accompanied by fracture of the head of the Radius and posterior dislocation, in which case the fracture is a combination of the Radial injury with a fracture which requires treatment similar to that prescribed for fractures above the condyles of the Humerus with displacement ; or it may be a simple fissure through the bone. Each condition requires the same treatment as is prescribed for the analogous fracture, the prognosis being also similar.

The last three groups, viz., fractures of the head, separation of epiphysis and fracture of the styloid process, all present one great similarity, namely, the concomitant injury to the wrist and radio-ulnar joints and to the soft structures. Such injury is of more importance than the bony injury. Treatment must proceed on the lines already indicated for fractures through the lowest inch of the Radius. These injuries, when treated by massage and mobilisation, will be found to be little more than trivial, being, as a rule, much more readily cured than correspondingly severe fractures of the Radius. Few, if any, of these fractures call for treatment

as prescribed for fractures of the Radius where there is a tendency to free mobility of the lower fragment. Splints are seldom necessary.

### FRACTURES OF THE OLECRANON

#### *General Considerations*

The amount of displacement of the upper fragment depends, in these cases, on the position of the fracture and the strength of the aponeurosis spreading downwards from the attachment of the triceps. The fracture may be complete and yet the aponeurosis may prevent displacement : it usually does so if comminution is present. The site of fracture which is most favourable to wide separation is at the level of the upper surface of the Coronoid, the fracture being transverse. If the fracture is oblique the tendency to displacement is small, unless it allows of posterior dislocation of the fore-arm. Separation of the Olecranon epiphysis is one of the rarest forms of epiphysial detachment (Poland).

Wide separation of the fragments is no contra-indication to treatment by mobilisation and massage : in cases where operative interference is rejected perfect functional utility may be restored. In the absence of separation, operation is strongly contra-indicated.

*Classical Treatment*

Cheyne and Burghard recommend wiring for all cases of fractured Olecranon except where there is "little or no displacement." For such cases, or if operation is contra-indicated, a long straight anterior splint with a pad at the bend of the elbow is recommended. "An attempt should also be made to bring the upper fragment into contact with the lower by strapping . . . the fracture will have to be kept in this position for something like six weeks," with passive movements "from time to time. . . . Even after passive movements there is often a considerable amount of stiffness left." An anæsthetic may be needed to break down the adhesions.

Rose and Carless, while urging the desirability of operation, recommend massage and movements after a fortnight as part of palliative treatment.

The Scotch text-book, on the other hand, says, "It is still an open question, however, whether the results after operation are better than those obtained by one or other of the non-operative measures to be described," though these measures consist of methods of fixing the forearm in full extension and pulling

down the small fragment by means of various contrivances. Massage and movement begin after the first week.

Holmes, of course, refers to palliative treatment only, advising full extension for a month.

### *Massage Treatment*

Diagnosis is obvious if there is much separation. If the fracture is complete there will be a great and instantaneous swelling of the elbow-joint. In cases of direct injury the swelling of the bursa may mask that of the joint itself. The patient supports the injured limb with the other hand and withdraws this support with reluctance. X-ray examination is always advisable, as there is great difficulty in determining the presence of subsidiary fractures. If separation is absent a spot of exquisite tenderness may be found, even without recourse to massage, on palpation of the posterior edge of the bone. If any length of time has elapsed since fracture, massage may be essential to establish diagnosis with certainty.

As already stated, Prof. Lucas-Championnière prefers to treat a fractured Olecranon by massage and movements rather than by operation as a general routine. He says, "I have always had

such perfect results that I now consider a fracture of the Olecranon as one of slight importance," and that "bony union is the rule," though he does not mention the evidence on which this opinion is based. I have failed so far to obtain bony union in cases where there has been wide separation of the fragments.

It is usual to class fracture of the Olecranon and of the Patella together, for the purpose of treatment, but to do so is totally to disregard two most important factors. In the first place there is no tendency for fibrous and aponeurotic tissue to insinuate themselves between the fragments of a fractured Olecranon, so marked a feature after fracture of the Patella; and, secondly, the vascularity of the Olecranon is far superior to that of the Patella.

The main objective in massage treatment is to afford the most perfect relaxation of the muscles, and this can only be attained in the position of perfect comfort, namely, as in the case of all fractures of the upper extremity, semi-flexion of the elbow with the hand midway between pronation and supination. Full extension, if long maintained, is calculated to prove the acme of discomfort, more especially if any attempt is made to pull down the upper fragment. It produces spasm of the triceps,

which must inevitably overcome the inadequate measures taken to oppose it.

These fractures comprise the only type found in the upper limb where massage may be most readily applied in the recumbent position. The elbow is usually flexed to some  $135^{\circ}$ , which is most favourable to the simultaneous treatment of both arm and fore-arm presently to be described.

Ten minutes at least must be devoted to the arm-muscles, particularly the triceps, and it will be noticed that the separation between the fragments will slowly become less marked until it is impossible to establish the lack of continuity without lateralising the smaller fragment. As soon as the spasm of the triceps shows clear signs of remission the massage movements are made to extend on to the fore-arm, though still continued over the arm. Five minutes of this treatment should be enough. During the next five or even ten minutes massage is continued, but coupled with slow movements of minute amplitude imparted to the elbow, the fore-arm being gently rotated.

By this means the presence of other fractures may be determined and, at the same time, the fore-arm is gradually flexed to a right angle in which position the splint is applied.

The earlier the case is seen, the more rapid

will be the disappearance of the pain, which for some unexplained reason does not appear to reach its maximum intensity until after the lapse of some considerable time; though a possible explanation is that the simultaneous injury to the ulnar nerve is so severe that its sensitiveness is temporarily numbed, returning only with lapse of time.

An internal angular splint is then applied and the treatment is concluded by such movement of the wrist and fingers as the splint will allow. The patient is instructed to exercise the fingers freely.

In the after-treatment an important point to bear in mind is that a large muscle has been torn from its insertion, and that the nutrition of a muscle is dependent on frequency of contraction.

The wasting of the triceps in all cases of fracture of the Olecranon is therefore extremely rapid, and is accompanied by a corresponding degree of atrophy in the flexor muscles, apparently due to some reflex disturbance of the trophic centres. It is not sufficient, therefore, merely to overcome spasm and afford relief from pain during the subsequent treatment, but massage must be so prolonged as to counteract all tendency to atrophy in both flexor and extensor muscles. For this purpose massage

for fifteen to twenty minutes a day may be necessary, and even this will fail to prevent a slight degree of wasting. After suture it is usual to immobilise the limb for a week or ten days, and, during this brief period, wasting of the muscles progresses so rapidly that ultimate restoration of strength requires much more prolonged treatment than is the case if massage is practised from the outset. Skilled massage is not contra-indicated by the presence of a wound which may be protected with collodion or varnish and rigorously avoided ; but surgeons at the present time are reluctant to allow such treatment until the wound is thoroughly healed, and until continuous massage is allowed the full benefits of suture cannot be obtained.

The prolonged massage, however, has a disadvantage. Pain, though very severe, is readily relieved ; and since the continuance of the massage produces so profound an anæsthesia that movements of injurious amplitude may be performed without causing renewal of pain, patients are liable to become impatient of continued prohibition to use an arm which appears to be cured. This is the only reason why the use of a splint is advocated. If the patient is intelligent, there is no reason why he should not be allowed the full use of his

hand for such purposes as cutting up his food, holding a paper or book, and so on, as soon as pain has been fully relieved. All movements involving supination should be encouraged.

In addition to the general massage, the region of fracture requires special attention. For this purpose it is wise to utilise the two thumbs, and it is as important to massage the anterior aspect of the joint in this way as it is to massage the actual neighbourhood of the fracture. Three or more days should elapse before the local treatment is undertaken.

The deltoid is not to be allowed any freedom of contraction for a fortnight. It therefore requires particular attention, and the patient should be taught to make this muscle contract frequently, without, however, abducting the arm more than a few degrees.

Each day the patient arrives with the forearm bent to a right angle. Massage must be commenced in this position, but the hand is slowly allowed to drop until at the end of five minutes or so it is in the position described above as most suitable for treatment. Massage being concluded, movements of the shoulder and full movement of the wrist are performed, rotation receiving special attention. Supination will be somewhat limited so long as swelling

persists. This is of no moment; repeated small doses of rotation will prove effective in preventing adhesions, and the amount of supination possible will steadily increase until it is complete by the end of the first week. The fore-arm is slowly raised to a right angle and the splint re-applied. A natural desire will arise to increase flexion beyond this point in order to avoid stiffness. Under no conditions should this be done for the first fortnight. By that time union will be firm enough to allow the increase without injury, and there need not be the least fear of failure to obtain full flexion immediately the union is sufficiently firm.

For the first fortnight treatment should be on the lines indicated. If there is any tendency to abuse freedom a splint should be used for ten days, or more if necessary, finger exercises being alone prescribed. By the end of a fortnight the hand may be used "underhand" freely, but on no account is the arm to be raised above the head or any effort of extension allowed.

During the third week full flexion is gradually restored, but until the end of this week the clothes must be put on jacket-wise, to avoid raising the arm. By the end of this week the fracture may be considered as cured and free

use is allowed. But the "freedom" of use must be regulated, and with this object it is wise to keep the patient under observation for another fortnight or three weeks, the simplest way being to advise massage on alternate days. Four weeks should suffice for the perfect restoration of movement and of strength for the common feats of daily life, such as the adjustment of the back collar-stud. Another fortnight of exercises is necessary before resuming laborious work. Danger of stretching a fibrous union is minimal if treatment be carried out as described.

In all cases a few fibres of the triceps fail to regain their insertion. This failure leads to a minute amount of atrophy in the middle line, and is not to be evaded by any form of treatment.

The only result of fracture of the Olecranon at the end of six weeks should be that there is, on close inspection, a slight appearance of broadening of the elbow, while careful palpation may fail to reveal the site of fracture. If, however, there persists an obvious space between the fragments, and this is rarely the case, it may prove impossible to restore full extension ; but the restoration should be such that the deficiency would pass unnoticed by practitioner

and patient alike without careful comparison with the sound limb. The shortening of the distance that separates the origin of the triceps from its insertion is calculated to give additional strength to the muscle, and not to weaken its power of contraction, even though full amplitude of movement remains impossible.

At one period of treatment, usually during the second week, it is no unusual event to find that there is still some obvious limitation of extension. It may be a matter of some fifteen degrees. This is readily overcome. Treatment is now carried out while the patient is sitting on the edge of a chair, the sound arm resting on its back while the injured limb is allowed to hang straight down in such a manner that no portion of the limb touches the body. Massage is performed as before, and the elbow is slowly extended. Presently the limit is reached. If the right Olecranon has suffered, the practitioner grasps the patient's hand in his right hand while continuing massage with his left throughout the whole extent of the posterior aspect of the injured limb. The right hand is made to exert a mild traction perpendicularly, and a minute addition to the degree of extension is made every time the massaging hand passes over the region of the elbow. The sum of these

minute additions will in the course of three or four days be found to have completed the movement. The practitioner will find the treatment awkward to carry out unless he kneels by the side of the patient on a low stool.

Where there is much separation, and the patient is young or has a laborious occupation, or indulges in any pursuit where full extension is desirable, such as boxing, fencing, and the like, operation may be advised. Such advice, however, will rarely, if ever, be justified by results. Women and all patients of advancing years should be recommended treatment by movements and massage.

If there is no displacement the only alteration in treatment should be that no splint is applied, a limited use being prescribed from the outset ; flexion may pass a right angle at the end of the first week ; a sling is discarded at the close of a second week, and free use is allowed a week later. Laborious work may require an extra fortnight for exercises.

#### FRACTURES OF THE SHAFT OF THE ULNA

These are trivial accidents. There is rarely any displacement ; if present it is easily corrected and does not tend to recur.

*Classical Treatment*

Fracture of the shaft of the Ulna alone should be treated by early massage and passive movements, according to Cheyne and Burghard, and splints may be abandoned in four weeks.

If the head of the Radius is also involved the fore-arm must be put up in splints at right angles to the arm and rather more supinated than in other cases. Passive movements should be begun within the first fortnight.

The three text-books all prescribe similar treatment.

*Massage Treatment*

Diagnosis, owing to the large area of bone which is subcutaneous, is easy, the point of exquisite tenderness being readily established in the absence of displacement.

Whether deformity is present or absent the treatment appropriate to fractures of the Radius without displacement should be employed. There is only one point of great importance. For some three inches above the head of the bone the vascularity is very poor indeed, and union is correspondingly slow. At least a fortnight is required before a fracture in this situation may be said to have united firmly; and use of the limb should be delayed for at

least a week longer than in cases of fracture of the Radius or any other part of the Ulna.

Fractures of the upper two inches of the bone usually present complications which must receive appropriate treatment, the injury to the Ulna, in these cases, being of secondary importance.

## CHAPTER XIX

### FRACTURE OF BOTH BONES OF THE FORE-ARM

#### *Classical Treatment*

WARNING is given by Cheyne and Burghard against two dangers in the treatment of fractures of both bones of the fore-arm. These are non-union of the Radius and cross union.

If the fracture be above the insertion of the pronator radii teres, anterior and posterior splints are applied in full supination: if below this point, the position must be midway between pronation and supination. Instructions are given to fit wooden splints by cutting them to the approved shape. “The splints must not be altogether discarded until about the fifth or sixth week, and not then unless union be firm,” although active and passive movements of the fingers are to be practised from the first, and of the elbow and wrist after the first week.

For greenstick fractures they advise the use

of splints for three weeks, and a sling for another ten days.

Rose and Carless give similar advice, but Thompson and Miles suggest the use of splints for three weeks only, even in adults, while Holmes prescribes their use for a month, advocating movements of the fingers from the outset if necessary.

### *Massage Treatment*

Little need be added under this heading to what has already been said when considering fractures of the individual bones. As a general rule the periosteum of one bone has undergone so little injury that it may be relied upon to act as an internal splint, in which case the treatment advocated for the fracture of the other bone will need little, if any, modification.

When, however, both bones are so severely injured that free mobility is present the treatment must be modified. The pain is readily relieved, and a prolonged attempt should be made to mould the four fragments into position by manipulation while still continuing the massage. Patience will often yield a most satisfactory result. If at the end of twenty minutes, however, reduction is still imperfect, an anæsthetic must be administered. The most

satisfactory method of dealing with the case will now be found to be to ignore the fracture of the Radius, while the fragments of the Ulna are brought into as perfect apposition as possible. If this presents any difficulty the fore-arm should be bent till there is a marked concavity backwards, the ends of the Ulna are then approximated and rotated into a straight line. As soon as the position is satisfactory, pressure is exerted to make the serrated edges interlock and "bite." As a rule, it is a simple matter to secure enough impaction to permit considerable manipulation of the Radius without disturbing the fragments of the Ulna; though it may prove necessary to use the junction of the latter as a fulcrum, rotating the lower fragment inwards in order to pull down the lower fragment of the Radius below the level of, or into a straight line with, the upper fragment.

As soon as the restoration of both bones seems to be satisfactory it is wise to re-secure the impaction. An anterior splint is at once applied and massage is then continued for some ten minutes before the application of a posterior splint. It is often wise to fasten on a third splint to support the ulnar edges of those already applied.

As the result of massage it will be found that

the position midway between supination and pronation with the elbow flexed to a little less than a right angle is most satisfactory, and it is in this position that all manipulation should be attempted in the first instance.

The posterior splint must extend from the point of the elbow to the knuckles, the anterior from the crease in front of the wrist to about two inches below the crease of the elbow. This arrangement fixes the hand to the posterior splint only, and allows perfect freedom to the fingers.

The greatest care must be taken to ensure that no undue pressure is exerted by the sling on the ulnar border of the hand.

In children a green-stick fracture of both bones may require much discrimination in the choice of treatment. As a rule a good position can only be obtained by rendering one fracture complete ; and, if possible, the Ulna should be selected. Considerable manipulation may be necessary before arriving at a definite conclusion, but every possible precaution must be taken to avoid complete fractures of both bones unless absolutely necessary.

The splints in these cases are so short that it is often impossible so to adjust them that a satisfactory position is maintained, though the

attempt should always be made. About the third or fourth day it is not unusual to note that one or other of the bones has bent. This may happen even if the splints have not been disturbed for massage. The only satisfactory treatment for the condition is to apply a long posterior splint from knuckles to shoulder, the original short anterior splint being still utilised, or replaced by a long anterior splint as in Fig. 39. These splints must always be removed daily for movements ; and at the end of a week the anterior splint is discarded and the original posterior splint alone is applied. This should be worn for two or three weeks, according to the age of the child ; though free use is made of the hand, as far as the splint will allow, from the eighth or tenth day.

In all cases where there is danger of displacement of the fragments the posterior splint is removed daily for massage and is then re-applied prior to movement of the shoulder, elbow, wrist, and fingers being practised. On the fourth day both splints may be removed with care, and a few degrees of rotation are allowed for the first time. If the long anterior splint is used both splints must be removed daily from the outset.

By the end of a week about 50° of rotation should be administered, all other movements

being nearly complete, and the anterior splint is discarded. The patient is now allowed to use the hand, with a short posterior splint *in situ* for



FIG. 39.

Long anterior and posterior splints applied to the arm. Note that the fingers are perfectly free to move. The discoloration of the hand is an accidental photographic effect, but serves as a reminder that the patient must be kept in the recumbent position.

another four days, when the use of splints may, as a general rule, be abandoned ; though it is wiser, if the upper third of the Radius or lower

third of the Ulna is involved, to continue the use of the posterior splint until a fortnight has elapsed, as the bones unite more slowly if broken in these situations. By this time all movements should be perfect.

Provided there is end to end apposition, the appearance of a slight curve in one or both bones during the first ten days is of no moment : the bones can be re-moulded during massage without pain, nor does the repetition of such manipulation seem to have any prejudicial effect. The occurrence of deformity indicates inefficiency of splintage, and the necessary manipulations tend to give rise to an excessive formation of callus. This, however, is of no importance and rapidly undergoes resorption.

During the third week free use is allowed provided no strain is put on the bones, and by the conclusion of the week restoration should be perfect ; graduated exercises occupy the fourth week of treatment, if this seems desirable. Laborious work should not be undertaken for another fortnight.

In the absence of mobility of the fragments treatment may be advanced more rapidly. Splints are discarded at the end of a week, but perfect freedom should never be allowed before the completion of three weeks.

## CHAPTER XX

### FRACTURES OF THE CARPUS, METACARPUS AND PHALANGES

#### *Classical Treatment*

CHEYNE AND BURGHARD recommend the use of an anterior splint with the metacarpus thrown back for cases of fracture of the carpal bones. "Adhesions will be very apt to form." No time-limit is mentioned for the use of the splints.

For fractures of the metacarpals they recommend bandaging the fingers down firmly over a pad placed in the palm of the hand. A dorsal splint may be employed if "it is desired to exert a certain amount of pressure." The fingers are to be moved at least once a day. The contrivance is applied for a fortnight or three weeks, a sling being used "for another week or two."

The phalanges, if broken, are to be kept extended on a metal finger splint for three or four

weeks, movements being performed daily after the first week.

Thomson and Miles advocate very similar treatment, but Rose and Carless advise movements and massage for all fractures of the carpal bones.

Holmes also gives this advice, but the diagnosis was necessarily uncertain at the time his work was published. As regards the other fractures his remarks are very similar to those quoted.

### *Massage Treatment*

Fracture of the carpal bones is fairly common, the Scaphoid being most frequently involved. The Os Magnum suffers next in order of frequency.

Diagnosis is always difficult, and is usually made only as the result of X-ray examination, though fracture may be suspected owing to the intensity of the pain.

There is no displacement in the absence of dislocation, and the bony injury is insignificant as compared with that done to adjacent tissues and to the joints.

Treatment should invariably proceed on the lines indicated for treatment of fractures through the lowest inch of the Radius without displace-

ment, unless complicated, as is often the case, by such fracture with displacement. Should this be so, the carpal injury may be ignored. When occurring alone, fractures of the Carpus require no splint, and a large degree of freedom may be allowed from the outset. Restitution of functional utility should be complete in three weeks at latest.

Bony union is the rule ; if it fails to occur the patient suffers no inconvenience. The formation of excess of callus, given proper massage treatment, is unknown.

Fractures of the Metacarpus rarely exhibit deformity if the fracture is near the base, except in cases of Bennett's fracture of the first Metacarpal : if near the head, deformity is more frequent, but is often the result of an ill-advised attempt to elicit crepitus.

Deformity may, as a rule, be reduced by manipulation during the course of massage. In any case it is wise to bandage the fingers over a pad placed in the palm during the intervals between daily treatment for four days ; after which movements of the fingers are prescribed. These, however, must not involve any forcible closure of the hand. In a fortnight free use may be allowed, and after three weeks treatment is abandoned.

Persistent pain at the site of fracture, a frequent sequel to prolonged immobilisation, is unknown after massage treatment.

Treatment for fracture of the phalanges is very similar, but it may be necessary to substitute a straight splint for the pad and bandage. In this case a long dorsal splint, extending from the tip of the fingers to the level of the wrist, is usually more satisfactory than the ordinary metal finger-splint, and at least two fingers should be applied to the splint. It is, of course, removed daily for massage and gentle movements, and may be replaced by adhesive plaster at the end of a week. This is the best form of splint for cases where there is no displacement. It is a simple matter to apply the strapping in such a way as to leave the dorsal aspect of the joints uncovered. The strips must not be more than a quarter of an inch broad, and are so arranged as to form a kind of 8, with the crossing placed on the palmar aspect (see Fig. 40). The fingers may then be moved freely without danger of displacement. In some cases such an arrangement may be utilised from the outset.

Movements are prescribed in ten days, and free use is permitted towards the close of the third week.

Massage affords an efficient protection from the danger of non-union after all fractures of the long bones of the hand.

The fractures most apt to cause trouble and anxiety are, oddly enough, oblique fractures of the distal phalanx which involve the joint.

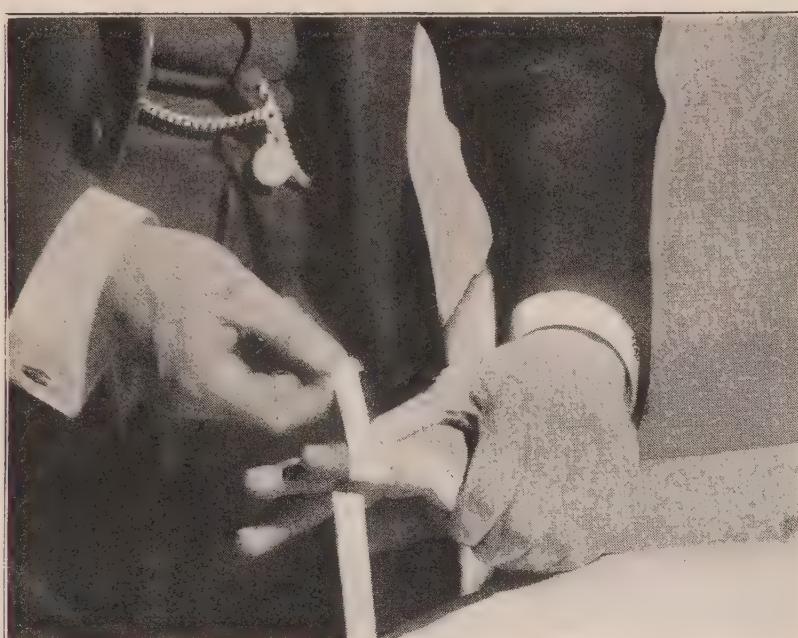


FIG. 40.

The application of an adhesive-plaster "splint" to a finger so as to permit movement of the joints. Two pieces of plaster are to be applied in the reverse manner before the "splint" is complete.

The reason of their difficult union is, presumably, that the vascularity of the proximal fragment is very poor. This fragment consists of a small triangular piece of bone, which carries a disproportionately large area of the articular surface.

Although displacement is very rare, its absence is apparently not due to the fact that

the periosteum is untorn since mobility is present in a marked degree.

There is a tendency in these cases to utilise local treatment only, ignoring the fact that such treatment can have but little reflex effect on the disorganisation of the blood-supply. In these, as in all cases of fracture in the wrist or hand, massage must include at least the whole area of the fore-arm. The local treatment of the individual finger is the least important part of treatment, and may be relegated to a very secondary position. Great care must be exercised to avoid undue mobility between the times appointed for treatment.

Although union should be quite firm by the end of a week, it is advisable not to discard the use of a splint for at least another three days. Free movement may then be allowed, but freedom of use must be prohibited until the third week is well advanced ; for union must be very firm before use.

## CHAPTER XXI

### FRACTURES OF THE HUMERUS

#### A. *Upper Extremity*

THESE consist of :—

1. Fracture of the anatomical neck.
2. Fracture of the surgical neck.
3. Separation of the upper epiphysis.
4. Separation of the greater tuberosity.

Fractures of the first and third classes are comparatively rare, and fractures of the fourth class are seldom seen alone, being usually accompanied by fracture of the surgical neck.

Fractures through the surgical neck present such wide variations that in many of them features are observed very similar to those met with during treatment of cases of separation of the epiphysis.

Treatment of fractures of the anatomical neck must depend entirely on the position of the upper fragment ; if there is little displacement the fracture may be treated on the lines advocated for the treatment of fractures of the surgical neck ; if it be great, and the head of the bone lies loose in the capsule, there would seem to be no alternative to its removal, in the event of its failing to assume a satisfactory position as the result of a few days' mobilisation and massage.

If any of these fractures should be accompanied by dislocation of the upper fragment, massage will often be found equal to reducing the dislocation. It may reduce spontaneously, provided that the case is seen within an hour or two of fracture. Otherwise an attempt should be made to effect reduction by means of mobilisation and massage under the influence of an anæsthetic. Failing reduction by this means, open operation becomes necessary ; when it will usually be seen that the most suitable method of treatment is to remove the head of the bone.

In the following pages attention is paid to the treatment of fractures through the surgical neck exclusively, incidental reference being made to the other forms of fracture.

*General Considerations*

Fractures of the surgical neck may be impacted, in which case it is most desirable to make no attempt to reduce the impaction unless gross deformity is present, a complication of very rare occurrence. We must regard the impaction as the first stage in the process of repair.

Forcible reduction in any other event is not only futile but even detrimental to the interests of the patient. If deformity is such as to make reduction desirable, it necessarily follows that the periosteum is grievously torn and can only function as an internal splint to a very limited extent. Short of open operation, therefore, we have no control over the fragments save such as may be afforded by external splintage. By such means it is possible to control movements of wide range, but quite impossible to prevent movements of small amplitude, which are at any rate sufficient to allow the force of muscular spasm in a transverse direction to draw the two ends apart. A similar spasm of the vertical muscles then causes a considerable degree of overlap.

Nothing short of firm impaction can as a general rule prevent recurrence of deformity if the

periosteum is severely injured. In such a case to attempt reduction under an anæsthetic is simply to invite return of the deformity as soon as the anæsthesia has passed off. If, on the other hand, the muscular spasm can be relieved, the weight of the limb acting in a vertical direction will suffice to restore the axis of the bone, while careful mobilisation will assist any irregularities to dove-tail into each other. I can find no other explanation of the fact that few, if any, of my cases, except when the fracture was impacted, have failed to present varying degrees of deformity at their first visit, which deformity had completely vanished before union had taken place. Two photos are reproduced as types :

- (1) Taken after setting and splintage, and
- (2) At the end of five weeks' treatment without any apparatus other than a linen sling after the first few hours. (See Figs. 26 and 27, p. 186).

Such reduction is the rule and not the exception as the result of massage treatment. One often has the opportunity of watching deformity gradually dwindle away and vanish under the hands during treatment, a striking example of this visible reduction of deformity having been referred to on an earlier page (66).

Violent reduction followed by more or less marked recurrence of deformity can only result in serious risk of injury to important structures.

A general law seems to govern the degree of displacement which occurs after fracture of the upper end of the Humerus at different levels. It may be formulated briefly by saying that the higher the fracture the less the displacement. Intra-capsular fracture being rare, it necessarily follows that such fracture accompanied by gross displacement is very rare. Fracture just below the tuberosities is always accompanied by displacement, which reaches its maximum when fracture extends some two inches lower. In this case there is nearly always comminution.

“In spite of important deformity,” says Prof. Lucas - Championnière, “. . . . perfect restitution of the functions of the limb” can be assured with fair regularity. “I have never seen,” he adds, “any really grave results as a sequel to fracture of the upper third of the Humerus.” In another place he has said that these fractures “have been robbed of their serious sequences, even in patients of advanced age.” The truth of these statements is beyond dispute when treatment by massage and mobilisation is undertaken from the outset. These cases and Colles’ fractures exemplify more clearly, perhaps, than

any other form of fracture the vast superiority of massage treatment over any other.

### *Classical Treatment*

Treatment of fracture of the surgical neck, according to Cheyne and Burghard, should commence with reduction under an anæsthetic. The limb is then immobilised by bandages, slings and a shoulder-cap. At the end of a week the apparatus is removed for passive movements, but is not discarded for four weeks. As a preliminary, should there be any tendency for the deformity to recur, extension should be applied for the first "few days," during which the patient is confined to bed, and afterwards as an adjunct to the ordinary retentive apparatus for three weeks. Should these measures fail operation becomes necessary.

For fractures of the anatomical neck they advise passive movement "from a comparatively early period," and slight modifications of the retentive apparatus. When the head of the bone is loose it must be removed. "A freely movable joint may be obtained if early passive movement is resorted to after operation."

For separation of the great tuberosity they consider "the only really satisfactory method of

treatment is operation," treatment with the arm at right angles to the trunk being too irksome.

Separation of the upper epiphysis is to be treated as if it were fracture of the surgical neck.

Rose and Carless commence their advice as to treatment of fracture of the surgical neck with the words, "Immobilisation of the fragments is absolutely essential in this fracture," and state that "it may be secured by the application of an axillary pad and a shoulder-cap, whilst the arm is kept to the side and the hand supported by a sling." This absolute immobility is, as has been already shown, unattainable by external splintage; unless, indeed, the preservation of immobility in a position of marked deformity is the desideratum. Massage and movements are employed from the third week, and union is considered "firm" in four and a half to six weeks. If the anatomical neck is involved they recommend massage from the fourth or fifth day, "passive movements to commence a few days later." Operation is advised for great displacement, as also for separation of the epiphysis if the position is unsatisfactory after reduction under an anæsthetic. The great tuberosity should be pegged in position, or the arm kept in a

position which is described as "most uncomfortable."

Little further information can be gleaned from Thomson and Miles, except that they say that operative treatment is rarely called for in fractures of the head, anatomical neck or tuberosities.

The teaching of Timothy Holmes varies only in detail from that already summarised ; but it is noticeable that he urges that "gentle attempts" to raise the shoulder should be made as early as the patient can bear them after the first three weeks, showing once more that he had realised the benefits of "early movement."

#### *Massage Treatment*

The patient's arms and chest must be bared, and he then stands upright. Inspection will usually determine diagnosis unless there is impaction. The outline of the shoulder itself remains unaltered, but the elbow fails to touch the side and is actually somewhat raised, though the elevation is not uncommonly masked by dropping of the shoulder. There is a marked swelling occupying the anterior concavity of the Clavicle, which extends slightly down the arm, and a groove may often be noticed on the surface running obliquely from the anterior axillary fold

to the point of the shoulder. A depression just below the level of the shoulder generally appears externally. There is no undue prominence of the Acromion. All the muscles are in spasm and there is intense pain. The fore-arm is then raised and supported by the sound limb, and gentle palpation of the axilla is allowed. The upper end of the lower fragment can often be felt, and the presence of the head of the bone in the glenoid cavity established. That the patient has suffered severe injury is obvious, and massage will be the most suitable treatment for such injury, whatever its exact nature. It is well, therefore, to postpone this portion of the examination until a free dose of massage has been applied. If there is any deformity crepitus will be felt as the muscular spasm is relieved.

It would appear that with separation of the epiphysis the upper end of the lower fragment may be felt in the swelling below the Clavicle, "a striking and abrupt projection situated beneath the Coracoid process . . . which feels rounded and convex," to use the words of Prof. R. W. Smith. This fracture may be looked for in patients between the ages of five and fifteen. It is said to be more common in boys.

Fracture of the great tuberosity leads to considerable spreading. The seat of maximum

tenderness in this fracture is external, while in the case of the other fractures it is situated over the most prominent part of the anterior swelling. If fracture is suspected and the clinical signs enumerated are absent, fracture of the anatomical neck is probable. The only distinctive feature of this fracture is that it may be possible to determine that the greater tuberosity moves with the diaphysis, but diagnosis will probably be made only as the result of X-ray examination.

Any attempt to elicit crepitation has a greater disadvantage than usual in cases of fracture of the upper end of the Humerus, since there will be danger of reducing impaction. The teaching of certain authorities as regards impaction after fracture of the upper end of the Humerus is to respect it. Why this should be so when the same teachers advocate reduction of all cases of Colles' fracture is not clear.

External rotation of the arm is impossible after dislocation: it is always obtainable after fracture.

Diagnosis being made, the patient may sit down and support his fore-arm on his knee or with the opposite hand; but it is better that he should stand, the fore-arm of the injured side resting on the fore-arm of the operator, whose hand grasps the elbow while massage is performed with his free hand (see Figs. 41—44).



FIG. 41.

Massage of fore-arm after fracture of the upper part of the Humerus. The injured fore-arm is supported by the masseur's fore-arm, the arm hanging straight down.

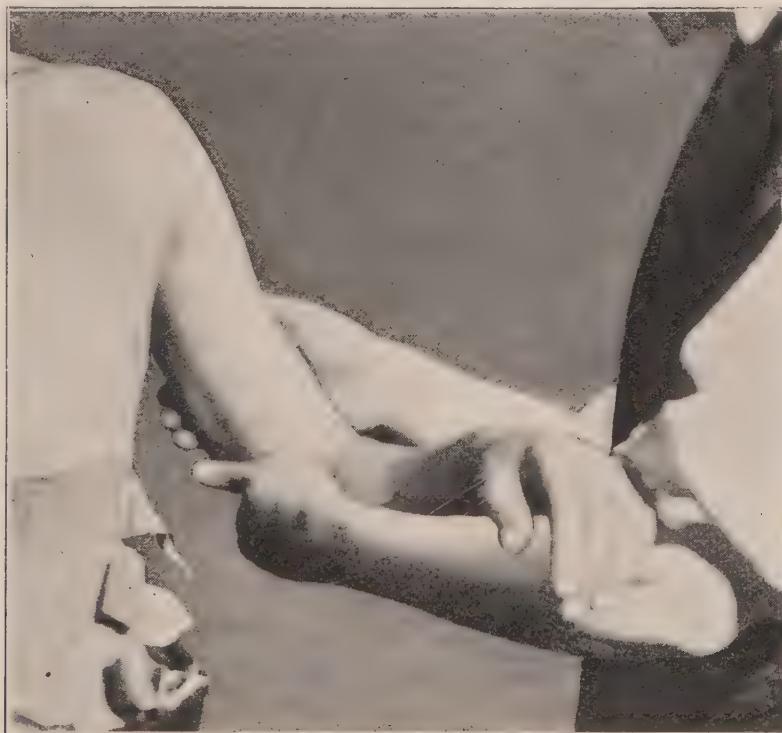


FIG. 42.

Massage of the back of the arm after fracture of the upper part of the Humerus as performed about the eighth or tenth day. At an earlier stage of treatment the fore-arm remains in the same position as in a sling and the arm is not abducted.



FIG. 43.

A second position for massage of the fore-arm after fracture through the upper part of the Humerus. The abduction of the arm is slightly exaggerated in this and the following figure.

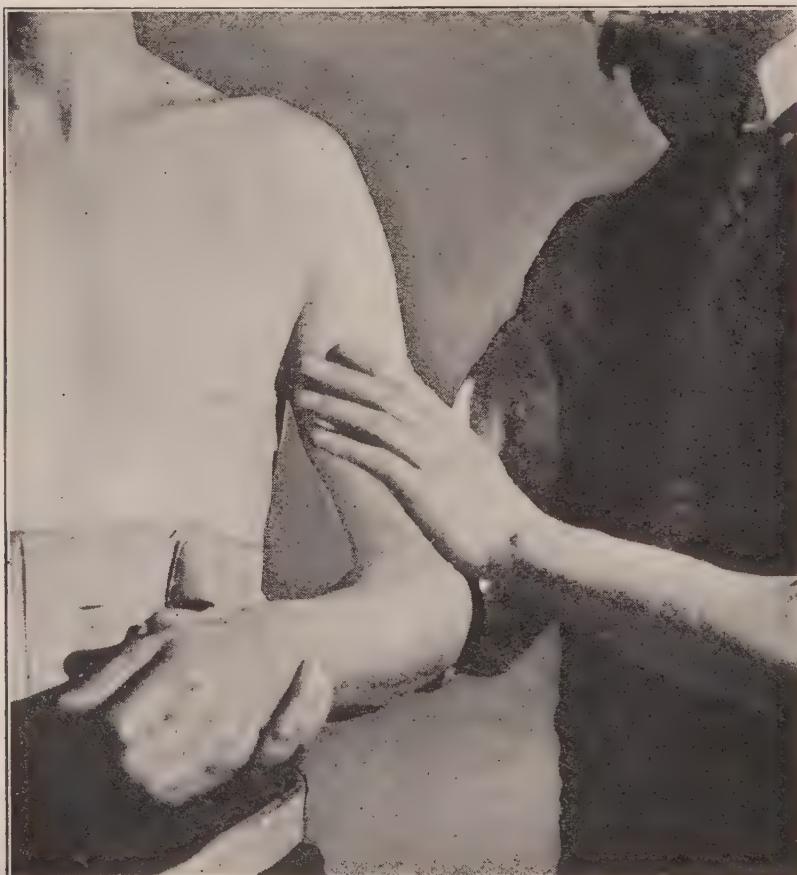


FIG. 44.

Massage of the front of the arm after fracture through the upper part of the Humerus.

When both hands are required for massage the patient may himself support the injured limb with his opposite hand with the help of a sling.

Treatment commences with gentle stroking of the outer and posterior aspects of the arm with the palm of the hand for about five minutes; then five minutes are devoted to other accessible parts, internal and front, both hands being brought into play. A third five minutes are spent on the trunk and neck muscles as described in the treatment of fracture of the Clavicle, special attention being devoted to the three segments of the deltoid. At some period, while the muscular spasm is passing off, crepitus will be felt if there is no impaction, but it causes no pain.

After the fore-arm has received a short dose of massage the elbow is grasped in one hand, the wrist in the other, and the fore-arm moved gently but frequently through a range of some  $30^{\circ}$  upwards and downwards. The elbow being still supported, movements of the wrist are performed, especially pronation and supination, while the patient is allowed to move the fingers.

The patient must be free from pain from the moment mobilisation is commenced, but the "anæsthesia" which follows massage in this region is so great that movements of a dangerous

amplitude are often possible without causing pain. Should pain return massage must be resumed till it again disappears, as it simply



FIG. 45.

Arrangement of sling for fracture of the upper third of the Humerus. Note that the sling in the neighbourhood of the elbow is quite loose, but taut over the distal end of the fore-arm, the wrist and the hand.

means that the dose administered has been inefficient.

Finally the glucokinesis is resumed for a few minutes, and then a large linen sling is applied and arranged with safety-pins so that the point of maximum pressure is near the hand, and so that there is sufficient material near the elbow

to fold a portion round behind the lower part of the arm and fix it to the front layer of the sling. (See Figs. 45 and 46.) A flannel bandage round arm and trunk gives a sense of security,



FIG. 46.

Fixation of a sling behind the neck over a pad of wool by means of a safety-pin: a simple remedy for the great discomfort often caused by a sling.

but it must be loosely applied. An internal angular splint is often useful, but only in so far as it is a source of comfort to the patient.<sup>1</sup>

<sup>1</sup> N.B.—Prof. Lucas Championnière advises that when there is very free mobility an anæsthetic should be given, deformity reduced, and a prolonged dose of massage administered before recovery of consciousness. The limb is then immobilised for four days. I have treated many of these fractures with very free mobility of the fragments, and have never had cause to regret the omission of temporary immobilisation.

Patients are allowed to walk about, but must not lie down ; they must sleep in an arm-chair, which is usually a more satisfactory method than being propped up in bed, where one is sure to slip down. This instruction is frequently ignored on the first night, but never again !

The next day massage and movements are carried out as before, but movement is slightly more free, and one hand may be passed into the axilla while the other seizes the elbow, the patient's fore-arm resting on that of the operator. The elbow may then be raised to and fro from the side for about four inches. (See Fig. 47.) Progress is gradually made till, at the end of the week, the fore-arm may be allowed to hang free, while abduction is carried almost to the horizontal. A tentative attempt may now be made at rotation, and if the head of the bone is felt to move freely with the shaft, as in eight days it certainly will, the underclothing may be split up in front and put on like a coat. Use may now be granted to the hand for feeding and other such purposes provided the patient is intelligent and promises not to raise the arm from the side. The sling may be discarded on the next day, and the patient allowed to lie down again.

Three days later the patient is advised to

attempt abduction through about ten degrees by means of the deltoid, whilst supporting the weight of the fore-arm with the sound limb. This must be repeated frequently, and special



FIG. 47.

Position of masseur and patient for mobilisation of the shoulder in all directions after fracture through the upper two-thirds of the Humerus. The right hand can give support where necessary. Note that by moving the left fore-arm in various directions the masseur can administer a dose of flexion and extension to the elbow, and also a certain amount of rotation to the fore-arm without interfering with the mobilisation at the shoulder.

attention must be paid to this muscle every day during massage. It wastes more rapidly than any other muscle in the body, and complete recovery after wasting is most tedious, supposing that it ever takes place. It is well to repeat that

it is the frequency and not the force or extent of contraction that best serves to maintain nutrition.

Within a fortnight of fracture the patient may be fully dressed and allowed to use the fore-arm and hand as freely as is compatible with absence of pain. Early in the third week rotation is practised daily and exercises with the roller-towel and weight and pulley are commenced. A description of these latter will be given when treatment of fractures of the Clavicle is described.

By the end of the third week union may be regarded as firm enough to allow perfect freedom of movement, passive movement being used for the execution of any movement which causes pain if performed voluntarily.

The only danger is that patients will try to do too much, and care must be taken to see that one's instructions are obeyed. If there is a doubt about this it is easy to convince a man that his recovery is not complete by a perfectly harmless though painful pressure; if he is still disobedient a bandage must be applied over a sling.

By the end of four weeks many patients will be completely cured, when it will only remain to prescribe exercises calculated to restore the strength which may be required for particular

occupations. Two weeks of these will generally suffice, though an extra fortnight may be desirable before the more laborious occupations are resumed. The rapidity with which strength is restored is illustrated by such cases as those of a ballet-dancer who resumed her engagement in three weeks, a painter who got back to work in five (though he complained of finding a certain difficulty in white-washing), another painter who unloaded two tons of coal during the eighth week of the fracture, and a woman of 68 who made her bed after three weeks' treatment. Out of fourteen cases of fracture of the surgical neck without simultaneous fracture of the greater tuberosity the average duration of treatment was 38·5 days, with a maximum of 78 and a minimum of 17 days. All resumed their wonted occupations.

The exercises recommended for all fractures of the arm are of the simplest character. Exercises similar to those prescribed for the treatment of Colles' fracture may be carried out during the first week in order to ensure that the condition of the fore-arm and hand shall not hinder ultimate recovery.

Early in the third week, and occasionally as early as the tenth day, the roller-towel exercises are commenced. These are supplemented three

days later by exercises bringing into play every muscle in the limb by means of traction applied in various directions to a cord which is passed over a pulley and is attached at its other extremity to a weight. A weight of 3 lbs. will be enough to start with, to be slowly augmented as strength returns. In no case should elastic tension be substituted for the pulley and weight.

A serviceable method of assisting the return of the power to extend the arm above the head is to get the patient to make a light pencil mark on the wall. The palm of the hand is then applied to the wall at a lower level, and the fingers are made to crawl up the wall to the mark. When this is reached, the hand is gently raised from the wall and held in the air at the level of the mark for a few seconds before it is again lowered and the exercise repeated. It is safe to employ this method of restoring movement at any time during the third week. The mark is raised each day.

At the end of the third week a broom-handle or other strong and rigid bar may be grasped in both hands and the injured limb made to perform various movements at the instigation of the sound limb.

Exercises of pure rotation are very difficult to

prescribe, and perhaps the most efficacious is one that corresponds to the method employed to assist rotation of the wrist. It consists of grasping a stick weighted at one end, rotating it round and back again with the arm held out at right angles to the body. It is an uninteresting exercise, but its performance should be insisted upon, rotation being the one form of movement which is often apt to be a stumbling-block. At the earliest possible moment the patient should be encouraged to place the hand in the small of the back, and, when in this position, to attempt to fasten hooks or braces ; and, similarly, to practise the fastening of the back collar stud or corresponding hooks.

Fracture of the surgical neck, when combined with fracture of the greater tuberosity, is a more serious injury. Treatment, however, is identical, and the increased severity of the injury should not add more than a week to convalescence.

Fracture of the tuberosity alone will yield excellent results in three weeks, the earlier stages of treatment being curtailed. This fracture is always intensely painful. Only one modification of treatment will be required, namely that special attention must be paid to the

region of the supra- and infra-spinatus. The deltoid, too, will have suffered direct injury, and more than ordinary care must be exercised to maintain its nutrition.

### B. *Fractures of the Shaft*

#### *Classical Treatment*

Fractures of the shaft of the Humerus, according to Cheyne and Burghard, require "special care, because there is a marked tendency to the occurrence of ununited fracture . . . probably the chief cause of this is neglect to properly fix the elbow joint after reducing fracture." Great stress is laid upon keeping the long axis of the fore-arm parallel to the antero-posterior axis of the body, if the fracture is below the insertion of the Deltoid. Splintage is described in detail, and is to be left in position for "four or five weeks"; but the splints should be removed daily after the first fortnight "for passive movements." If the fracture is oblique, there is a great tendency for the fragments to override." If this be "serious" operation is called for.

Thomson and Miles advise massage from the second week onwards but otherwise the text-

book advice is very similar to that given above, the treatment prescribed by Holmes being identical.

### *Massage Treatment*

If displacement is present diagnosis may be obvious as soon as the patient is undressed. Shortening may be detected by comparing the distance between the acromial angle and external epicondyle on the two sides. In the absence of deformity diagnosis can only be made by the discovery of a point of exquisite tenderness on the bone (best felt on the inner side), after massage and the subsequent use of the X-rays.

No attempt should be made to reduce deformity or impaction. The latter, however, is rarely present. If the deformity does not reduce as the result of massage there is a mechanical obstruction, which can only be overcome by operation. If operation is contraindicated or refused a serviceable limb may result in spite of persistent deformity.

Treatment is similar to that for fracture of the surgical neck with the exception of the following details.

Shoulder movements should be prescribed more freely, the fracture being supported by

the hand of the operator (see Fig. 47, page 335). Elbow movements, on the other hand, must be advanced with corresponding care, full extension being permissible by the twelfth day.

Callus formation is very rapid, and care must be taken to guard the fragments from unnecessary movement which always tends to encourage excessive formation. It is wise, therefore, only to attempt very limited movements until union is firm. The loss of amplitude of movements which are often repeated will involve no loss of suppleness.

Union occurs at the end of ten or twelve days, and, until it has taken place, the patient usually prefers to wear a splint.

An internal angular splint is the most comfortable for the first week, when it may be replaced by a long straight splint applied to the outer side of the upper arm.

By the twelfth day the patient may be dressed ; and exercises may be commenced at the end of a fortnight, by which time free use is allowed for feeding, dressing, &c. The use of a sling is abandoned after the third week.

By the end of the month any ordinary occupation may be resumed, but for heavy labour another fortnight's treatment by exercises is advisable.

One form of fracture of the shaft requires special notice, namely when the bone is broken some inch and a half above the usual site of supracondylar fracture. It is a not uncommon type of accident, and the lower fragment, being tilted forward by the action of the fore-arm muscles, frequently “button-holes” through the periosteum. Short of open operation there is no hope of reducing the deformity. Should operation be impracticable an excellent result may be obtained by massage and mobilisation. The elbow must never be extended beyond  $75^{\circ}$  for twelve days, though treatment is carried out daily on the lines indicated in the next chapter. At the end of a month the only persisting disability should be failure to obtain the last  $10^{\circ}$  of flexion, together with perhaps half-an-inch of shortening ; neither condition being perceptible by the patient in any of the ordinary occupations of life.

## CHAPTER XXII

### FRACTURES OF THE HUMERUS (*Continued*)

#### *C. Fractures of the lower end*

THESE include :—

- (i) Supracondylar Fracture.
- (ii) Separation of Epiphysis.
- (iii) Fracture of the Condyles.
- (iv) Y- and T-shaped Fractures.
- (v) Fracture of the Internal Epicondyle.

#### *General Considerations*

Separation of the epiphysis is the most common of these fractures. Sufficient has already been said of the necessity for modified treatment for children, and details of this treatment on the first visit have been already supplied. (See p. 216.)

The treatment of other fractures varies only in degree: it will therefore suffice to continue

the description of treatment for a separated epiphysis while referring to the other forms of fracture incidentally.

### *Classical Treatment*

The deformity resulting from supra-condyloid fracture of the Humerus is, according to Cheyne and Burghard, liable to recur in any but "the fully flexed position," which is maintained by the use of a Croft's splint and sling. At the end of a week passive movements and massage are begun. "In about a fortnight the arm may be brought down to a right angle . . . the back splint, which must be put on afresh after each change in position, should however be worn for something like four weeks after the injury, at the end of which time the arm may be kept in a sling and the patient encouraged to move it. Usually a prolonged period of massage and passive movement is required."

Of T-shaped fracture they say that the only probability of securing a really good result is by operative interference.

For fracture of either condyle operation is most strongly advocated.

For fracture of the internal epicondyle an internal angular splint is recommended with a suitable pad and strappings to press the fractured

portion of bone back into position. If there be any difficulty, wiring is advocated. No advice is given as to the duration of immobilisation.

Beyond recommending a somewhat earlier recourse to massage Thomson and Miles indicate the same course of treatment.

Rose and Carless also advocate early massage and movement, and seem less inclined to operation.

Such teaching is a great advance on that recommended by Holmes. He refers to the value of "early" movement at the end of about three weeks, but quotes a work by Dr. Hamilton, according to which splints should be laid aside and movements commenced at the end of a week !

### *Massage Treatment*

On being undressed, the patient stands with the injured limb flexed to an angle of about  $130^{\circ}$ , the fore-arm being semi-pronated and supported by the opposite hand. There is great swelling round the joint within a few minutes. Deformity may be obvious, but special care must be taken to note any fulness just above the crease of the fore-arm. If present, a touch will serve to show that it is due to the presence of the lower end of the upper fragment pressing forwards.

The patient turns round, and the back of the limb is examined. The relationship between the epicondyles and the Olecranon is noted. The swelling may be so great as to render palpation necessary. The relative positions of the bony points are rarely altered in any form of fracture, unless dislocation is also present. If absent, and the Olecranon still projects beyond the general level of the back of the arm, fracture is established.

If, in a child, in addition to the Olecranon a second bony projection is noted on its outer side, it will probably prove to be the capitellum, and separation of the epiphysis may be diagnosed. If the fracture is recent, and the Olecranon is obscured by swelling to a greater extent than had been anticipated from the amount of general swelling present, hæmorrhage into the joint may be suspected, indicating that the fracture has involved the joint. Palpation will then reveal mobility of one or both condyles ; in the latter case a T- or Y-shaped fracture exists. No pressure will be necessary : a gentle touch will elicit a typical crepitus, which is said to yield the sensation of touching "a bag of beans" and strongly resembles the crepitus of tenosynovitis. The peculiarity is probably due to the presence of fluid between the fragments, consisting of a mixture of synovial fluid and blood.

If fracture is still unestablished pain should be relieved by massage, when gentle pressure may be applied directly inwards (and not backwards) to the external epicondyle. If this causes sudden pain and return of spasm, transverse fracture must be suspected and treatment proceeded with accordingly unless the diagnosis is negatived by X-ray examination. In the absence of such pain similar pressure is applied over the internal epicondyle, sudden pain revealing its separation.

If more than two hours have elapsed since the accident diagnosis may be impossible without the use of the X-rays; but even so the treatment described will still prove to be the most efficacious, since a traumatic arthritis of great severity must be present, and the correct treatment of this condition is by massage and movements. In other words, exact diagnosis is useless except in so far as displacement of fragments is concerned, though in the absence of fracture we may, having our diagnosis, advance the more rapidly with treatment.

It is important to remember that little or no limitation of movement need result from transverse fracture or separation of epiphysis without displacement or separation of the internal epicondyle.

Whether there is or is not deformity, the first

stage of treatment consists of supporting the fore-arm with one hand while gently stroking the arm muscles with the other. The deltoid should receive attention, but the trunk muscles may be ignored.

The fore-arm muscles receive attention five minutes later for an equal length of time, after which movements of the wrist and fingers are administered. Ten to fifteen minutes will usually be enough, particularly in children, to establish a profound anaesthesia; but in adults as much as half an hour may be necessary, as all fractures in the neighbourhood of the elbow require more massage for complete relief than fractures in any other part of the body.

The next stage calls for care and judgment. One hand embraces the elbow region, which may be done so gently as to cause no pain if pressure over all points of extreme tenderness is avoided, and the other grasps the wrist. If deformity has been present or suspected the forearm must be slowly flexed and extended. Movement through a range of five degrees is fully enough to begin with, and this is gradually increased until a range of at least  $90^\circ$  is attained. So gradually must the change be effected that four or five minutes elapse during these movements, which should not exceed ten a minute.

If pain returns massage must be recommenced followed by mobilisation, which must be performed just as if no movement had yet been attempted.

Under no circumstances must any movement be allowed until massage has been fully practised. If massage needs to be resumed the chances of obtaining painless movement are small and an anæsthetic may become necessary.

It may be confidently anticipated that the deformity of supra-condylar and T- or Y-shaped fractures, and of fractures of a single condyle, will be reduced by these movements with a perfect accuracy. A separated epiphysis may be found to resume its normal position, but often it will remain displaced. An internal epicondyle so rarely suffers displacement that it requires no consideration as yet.

Should position remain unsatisfactory open ether or C. E. mixture must be administered. No amount of violent flexion will reduce the deformity : the fore-arm must be slowly extended until a degree of hyper-extension is attained varying with the degree of deformity ; the Radius and Ulna must, that is to say, be brought into the same relationship to the lower fragment as is assumed in the normal condition of full extension. (See Figs. 48, 49, and 50.) This

will usually entail the widening of the angle on the front of the elbow to about  $210^{\circ}$ . The relationship of fore-arm bones to the lower fragment is maintained by tension exerted by

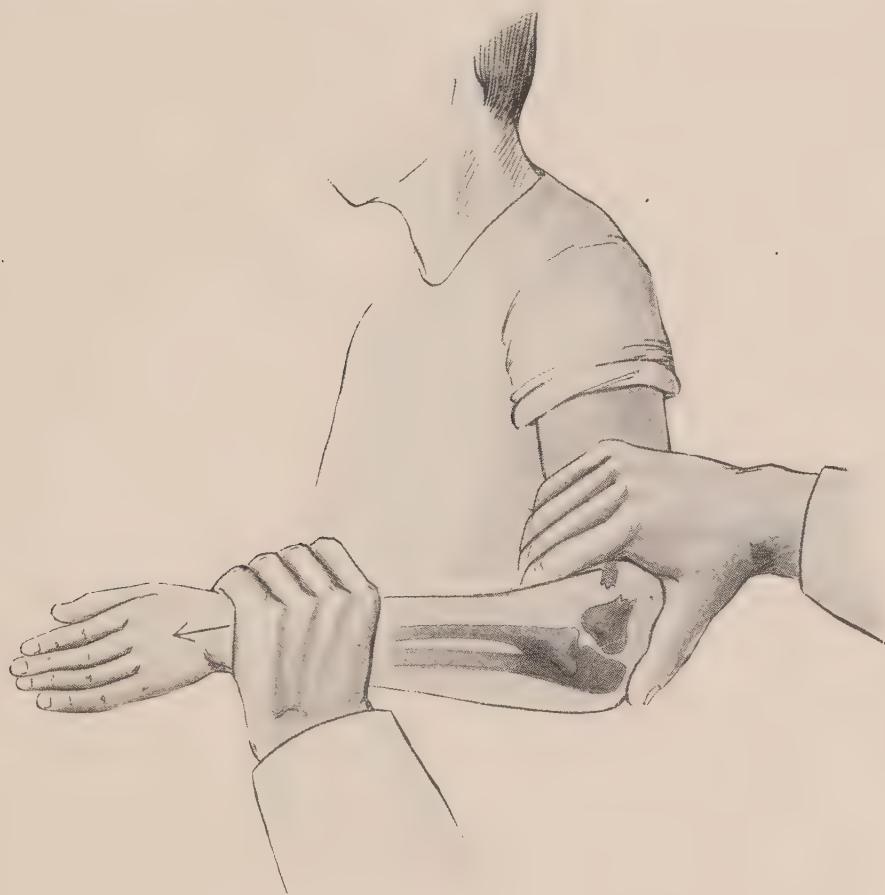


FIG. 48.

Diagrammatic representation of the parts before reduction in a case of supracondylar fracture of the Humerus. Note the obvious futility of traction in the direction of the arrow or of forcible flexion to reduce the deformity. (See Figs. 49 and 50.)

one hand while the thumb of the other presses the point of the Olecranon directly forwards. As this is felt to move the line of tension of the other hand is shifted in conformity with the movement until it is found to be exerted in the long axis of the shaft of the Humerus, due

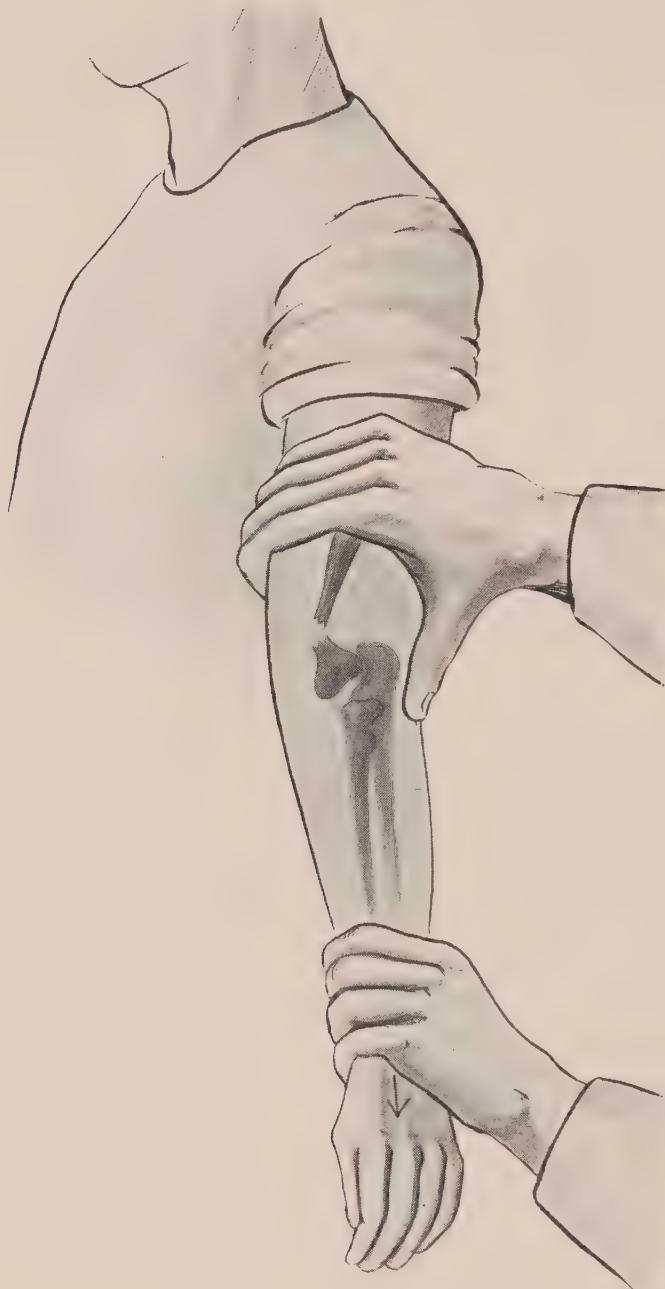


FIG. 49.

The key to reduction of deformity after supra-condylar fracture of the Humerus. The fore-arm is hyper-extended until the Radius and Ulna assume the relationship to the lower fragment that is normal in full extension. Traction by the left hand in the direction of the arrow then pulls the lower fragment downwards, when pressure with the right thumb on the back of the Olecranon pushes it forwards into the position shown. The fore-arm is then flexed while the traction and pressure are still continued, with the result that the lower fragment is rotated into position.

allowance being made from the outset to allow for the "carrying angle." Neglect of this pre-

caution is a frequent source of failure to effect satisfactory reduction. When this point is reached, the elbow is slowly flexed to a right

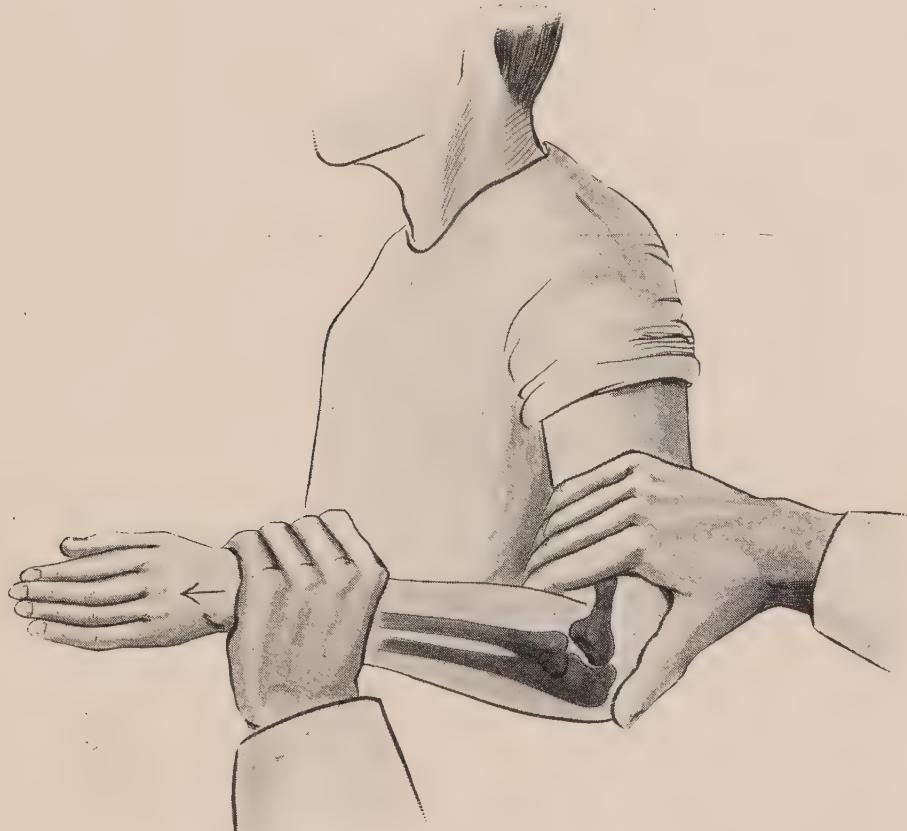


Fig. 50.

Final stage in reduction of deformity after supra-condylar fracture of the Humerus. Note that the pressure of the right thumb, though still directed forwards, is applied to the upper surface of the Olecranon and not to its posterior aspect as in Fig. 49.

angle, while the thumb continues to exert pressure on the Olecranon ; the point at which the pressure is exerted changes with the position of the bone, and the direction of the pressure remains directly forwards. When the right angle is reached the thumb will be pressing on the top

and no longer on the back of the bone, and the position is carefully noted. If any part of the Olecranon projects so far back as to touch an imaginary ruler applied to the back of the arm reduction is incomplete and the process must be repeated *ab initio*. Ultimate failure is a grave

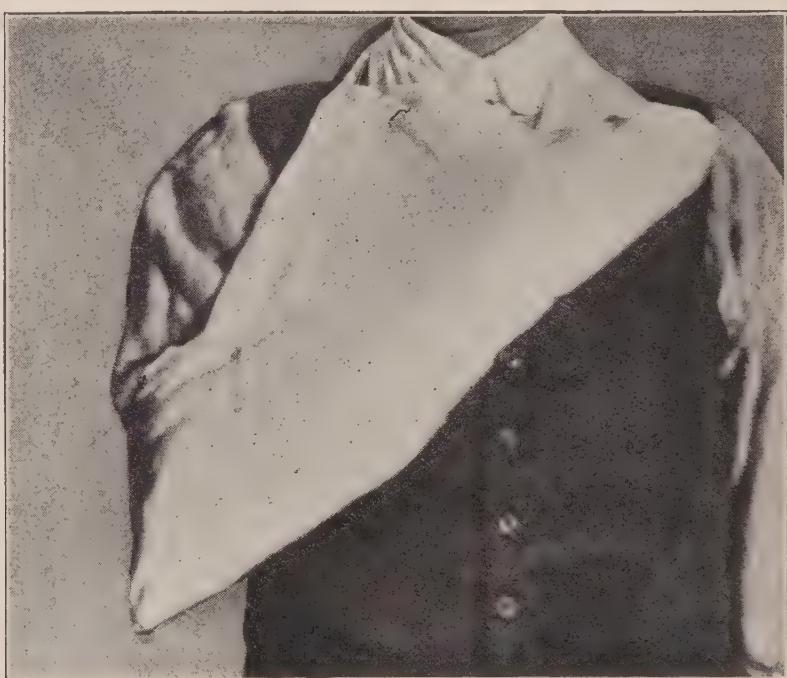


FIG. 51.

Arrangement of the sling after recent supra-condylar fracture of the Humerus.  
No splint or bandage is applied.

misfortune to the patient, as recourse to operation yields little hope of obtaining a more serviceable limb than treatment by mobilisation and massage in cases of separation of the epiphysis, which are generally speaking the only cases in which any anæsthetic is required to effect reduction.

Massage is practised for five minutes after all

manipulation has ceased, the arm being then fixed in a sling at an angle of  $45^{\circ}$  by means of safety-pins before any clothes are put on and while the patient is still under the



FIG. 52.

Arrangement of sling at a later stage after supra-condylar fracture of the Humerus; extension is slightly advanced and free movement of the wrist and hand is possible.

influence of the anæsthetic. (See Figs. 51 and 52.)

The treatment of cases when there is no displacement is similar, except that the wide amplitude of movements to ensure reduction of deformity is omitted. There is rarely any need for local treatment.

The next day the injured arm is held in position by the patient while the sling is removed. Massage is practised, to a limited extent in children, and movement of the elbow follows. An amplitude of  $5^{\circ}$  of flexion and extension should never be exceeded, five movements in each direction occupying at least a minute. It is well to administer the dose with one hand while the other continues the massage. Full movement of the fingers is allowed, and also full flexion and extension of the wrist, but only about  $5\%$  of rotation. The superior radio-ulnar articulation rarely escapes some injury, and early neglect to mobilise this joint may lead to grave disability at a later stage and greatly retard convalescence. The truth of this statement will be known to such as have carried out the after-treatment of cases where the elbow joint has been excised.

The sling is then re-applied as before and slight movement is administered to the shoulder in all directions. The dose of mobilisation is increased daily until by the end of the week full flexion should be possible, but extension should cease at a right angle. Not more than fifteen such movements should be administered. The position of the arm in the sling is now dropped by some  $10^{\circ}$  each day, and a similar addition is

made to the amount of extension prescribed. By the end of a fortnight the arm may be permitted to hang straight down for the first time and the patient is allowed to dress and begin to use the limb, though care must be taken to prevent excessive use by children and all risk of injury.

By the end of the third week exercises may be prescribed, and an adult may be allowed to abandon the use of a sling. Should extension still be imperfect a useful exercise is to hold a weight over the back of a chair, the axilla being protected by a cushion. The arm is allowed to hang for some twenty minutes, the weights being graduated. No attempt should be made to raise the weights. The "roller-towel exercise" and practice in supporting a weight over a pulley placed five feet or more above the head are also useful. Another week will suffice for the restoration of full functional utility, but laborious work should not be undertaken for a further fortnight.

Should the desire to hasten progress during the first fortnight prove irresistible, disaster, due to the formation of excess of callus, is almost certain to follow. No apprehension need be entertained as to the difficulty of obtaining full extension : such an accident is unknown except in the cases already referred to as "functional."

Danger of failure to maintain a satisfactory position, or to obtain union in fractures involving the joint, is equally remote.

A uniform treatment, regardless alike of the nature of the fracture and the age of the patient, will be found safest, unless the fracture consists of a simple fissure without injury to the periosteum. Such fractures are rare and treatment may be advanced more rapidly ; the patient being allowed to use the arm, with few restrictions, at the end of ten days.

The same may be said of fractures of the internal epicondyle, the arm in this instance being allowed to rest in a sling flexed to little less than a right angle from the outset ; but even in these cases it is wise to commence treatment with the small normal dose of mobilisation.

Although uniformity of treatment is advocated for all cases of fracture in the neighbourhood of the elbow, it is to be understood that the uniformity applies only to the dosage of mobilisation. The dose of massage must be regulated by the age of the patient, perhaps as much as half an hour being needed to produce in an adult the anæsthesia for which a minute or two would be enough in the case of a child.

Mr. Pringle, in his book *Fractures and Their Treatment*, pays a high tribute to Professor

Lucas-Championnière's work, but concludes his two-page examination of the method with the words: "it does not seem to me to be suitable for fractures of the shaft of the femur or humerus, or of both bones of the leg, while fractures at the elbow I believe should be treated by other methods." Let us contrast the opinion of Professor Lucas-Championnière as regards the treatment of fractures of the elbow. "I am able to state," says he, "that these fractures offer perfect opportunity for the treatment I extol. . . . The massage and movement should be practised with all the greater haste, according to the increased menace to the return of movement."

Wherefore, then, this divergence of opinion? Mr. Pringle's own description of the Professor's treatment affords sufficient explanation. Short as the description is, it contains the following statements which are diametrically opposed to the actual teaching of the Professor. "In the first place the fragments are naturally placed in as good a relationship to one another as is possible by manipulation." Here is entire disregard of the prime necessity of massage as a precursor of mobilisation, which should itself be the precursor of manipulation. The idea of "placing" the fragments in position, instead

of allowing them to assume their natural position as the abnormal conditions subside, with or without the aid of manipulation, forms no part of the Professor's treatment.

The description of the Professor's "massage en bracelet" is imperfect, and the remark that "even then it may be painful to begin with" indicates a truly remarkable conception of "glucokinesis."

When considering the question of mobilisation, Mr. Pringle says that "a hardy patient, willing to put up with a little pain, may in some instances be encouraged to make some active movements of the distal joints of the limb from the first"; and a few lines further on he advocates the use of elastic pressure between the sittings. Small wonder is it that the author comes to the conclusion that "the process is not fitted for all fractures by any means." But "the process" described is not by any means that of Professor Lucas-Championnière. The prescription of active movements liable to cause pain is foreign to the Professor's precept and practice, whether his patient is "hardy" or feeble; while the use of elastic pressure between the sittings is, as we have seen, detrimental when treatment by mobilisation and massage is undertaken.

This writer's version, or one must rather say perversion, of Professor Lucas-Championnière's methods has been selected for criticism as being typical of the accounts of his treatment as customarily set forth in English. It is nothing unusual to hear that a case has been treated by the Professor's methods: from the description of those methods in literature it may be assumed with a considerable degree of certainty that the treatment meted out has resembled his methods in few, if any, of the essential details. It may well be that fractures of the lower end of the Humerus are unsuitable for treatment by massage and mobilisation as at present understood in this country: nothing could be more satisfactory than the result of such treatment when applied in accordance with Professor Lucas-Championnière's instructions.

## CHAPTER XXIII

### FRACTURES OF THE CLAVICLE

#### *General Considerations*

FRACTURES of the Clavicle naturally fall into one of three groups according to the site of fracture, viz: fractures occurring at either end and those involving the centre of the bone. The last are by far the most common. The fracture is usually due to indirect violence; and, in spite of great displacement, there is rarely any injury to important structures, unless, as seldom happens, great displacement follows fracture due to direct violence. Occasionally there is comminution; but never, so far as I know, impaction. In children greenstick fractures are common.

Timothy Holmes says that "the fracture is susceptible of very complete repair. Usually, however," he adds, "considerable displacement remains during life, though it entails no ill effect beyond the slight disfigurement."

Displacement is but slight in the first two varieties mentioned, owing to the strength of the ligaments attached to the bone, though the outer end, if fractured, may tilt downwards a little. I have seen this on one occasion though Professor Lucas-Championnière says that he has failed to note it. Any deformity is possible with fracture near the centre of the bone and there is only one invariable element in the deformity, namely, that the outer fragment is inclined downwards. There is nearly always some rotation of the outer fragment, since the fracture is usually oblique from above downwards and backwards. There is also obliquity from without inwards.

The weight of the upper limb is usually held responsible for the whole of the displacement. This is unjust, as may be readily demonstrated. Deformity being noticed, the patient is made to lie down flat: the deformity does not disappear until either the muscles (so soon as there is no fear of movement of the fragments) relax and allow the deformity to reduce gradually, or the spasm has been relieved by massage. At first sight it would seem that fractures of the Clavicle are unsuitable for massage treatment, or at least that but little benefit could result therefrom. Professor Lucas-Championnière disillusioned me

on this point, and I have since repeatedly proved his view to be correct.

The deformity owes its origin to two causes ; the weight of the arm which tilts the outer fragments downwards, and the muscular spasm which causes adduction of the outer fragment and of the upper limb *en masse*. The rotation is largely due to muscular spasm, which also increases the tendency of the outer fragment to slope downwards. The inner fragment may be drawn upwards. I have never been able to establish the presence of this deformity, which, if it exists at all, can only be of slight extent.

Guilt has collected seventy different methods for the correction of the deformity : I have practical acquaintance with nine. Operation, of course, will leave least deformity, though massage combined with a very limited recumbency would approach it very closely indeed. Of the others, all appear to be equally unsatisfactory so far as the æsthetic result is concerned, and equally efficacious in affording firm union. Westmorland, of Georgia, maintains that deformity need not persist if the patient is placed flat on his back on a table, and is drawn slowly so far over the edge of the table as to render it possible to apply a plaster splint to the trunk and arm. I have no personal experience of this

method of treatment, but one hardly supposes that it would have any greater success than would attend many of the simpler methods. The main obstacle to be overcome in the reduction of deformity is the rotation : this, being due to muscular spasm, would be liable to recur after the application of the plaster. It would then be a simple matter to restore displacement.

The main object of treatment, then, being to restore functional utility as quickly as possible, treatment by mobilisation and massage will be found far to excel all other methods in this respect ; while, at the same time, it reduces the resulting deformity to a minimum.

### *Classical Treatment*

Timothy Holmes describes a method of "setting" the fracture, but does not mention the duration of treatment or prognosis, except in so far as deformity is to be anticipated.

Rose and Carless describe four methods of putting up the fracture, but duration and prognosis are ignored except for warnings regarding persistent deformity which coincide with those of Timothy Holmes.

Thomson and Miles describe five methods and add that firm bony union usually occurs within

twenty-one days. On other points they are as reticent as the other authors.

The same may be said of Cheyne and Burghard except that they advise that in Sayer's method the strapping should be "kept on for nearly three weeks, after which the arm is carried in a sling for another week." What the condition of the patient may be like after three weeks in the strapping they do not mention. They give priority to the "three handkerchief method," however, advocating massage from the first, the shoulder being moved in a week, the shoulder loops removed in a fortnight, and the sling in three weeks. They agree with the other authorities as to the necessity of ultimate deformity, short of operation or "the absolutely recumbent position."

#### *Massage Treatment*

Professor Lucas-Championnière urges his readers to remember the possibility of operation in bad cases.

For diagnosis, the chest and both arms are uncovered. The patient then stands up and the diagnosis is made. The point of the shoulder droops, the head is inclined to the injured side, deformity may be visible and the patient has an uncontrollable impulse to support

the elbow of the injured arm. In adults there is intense pain: children seem to suffer less, perhaps because the "greenstick" nature of the fracture reduces the severity of the muscular spasm necessary to maintain the immobility of the fragments.

If fracture has occurred at either extremity gentle palpation will reveal a point of exquisite tenderness on the bone. For fracture of the middle of the bone inspection should suffice.

Diagnosis made, the patient is seated with the fore-arm supported by the uninjured arm or on the knee and massage is begun. The whole of the palmar surface of both hands is used to massage the trunk muscles, a certain amount of rotation being imparted to the movement so as to follow as nearly as possible the direction of the fibres of the pectoralis major and lower fibres of the trapezius. (See Figs. 53, 54.) After about three minutes the rest of the trapezius and the sterno-mastoid receive attention for a similar length of time. The patient then lies down flat and about six minutes are devoted to the arm, the deltoid and all the muscles near their insertion to the bone receiving special attention. In this situation it is advisable to use the pads of the two thumbs only for the massage, when general massage of the

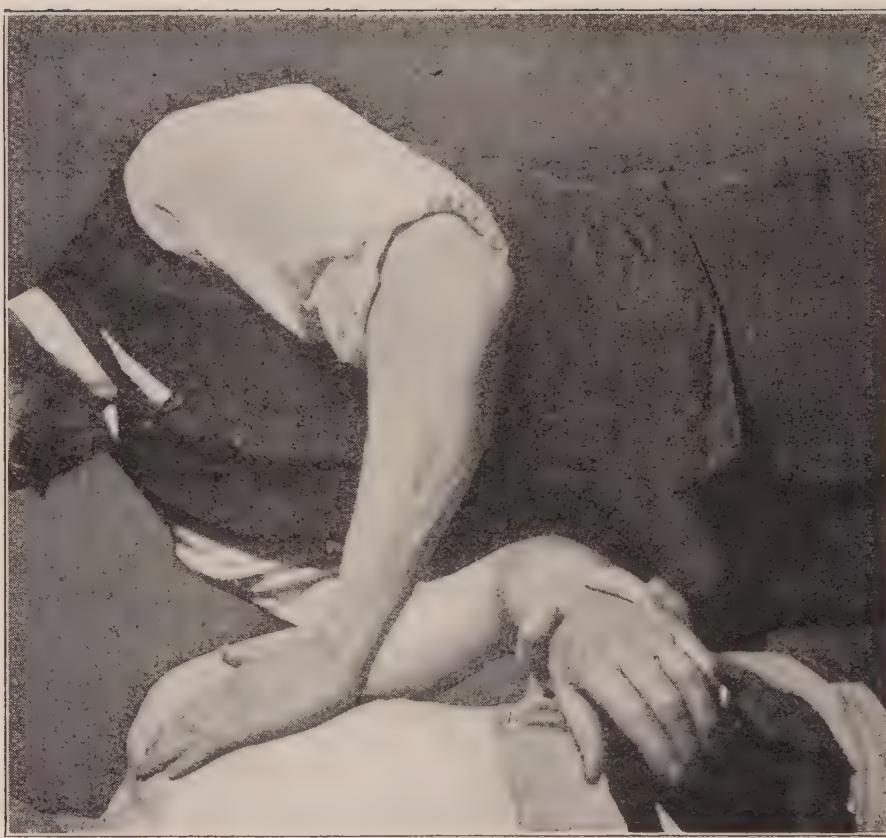


FIG. 53.  
First position in massage of the anterior aspect of the chest.  
(See Fig. 54.)



FIG. 54.  
Second position in massage of the anterior aspect of the chest.  
Note that the wrist has remained almost unmoved, and  
that the hand has been merely rotated. This movement is  
very closely allied to the "mouvement en meule."

whole limb has been completed. (See Fig. 55.) Pain is readily relieved and deformity vanishes as a rule without any manipulation. If manipu-

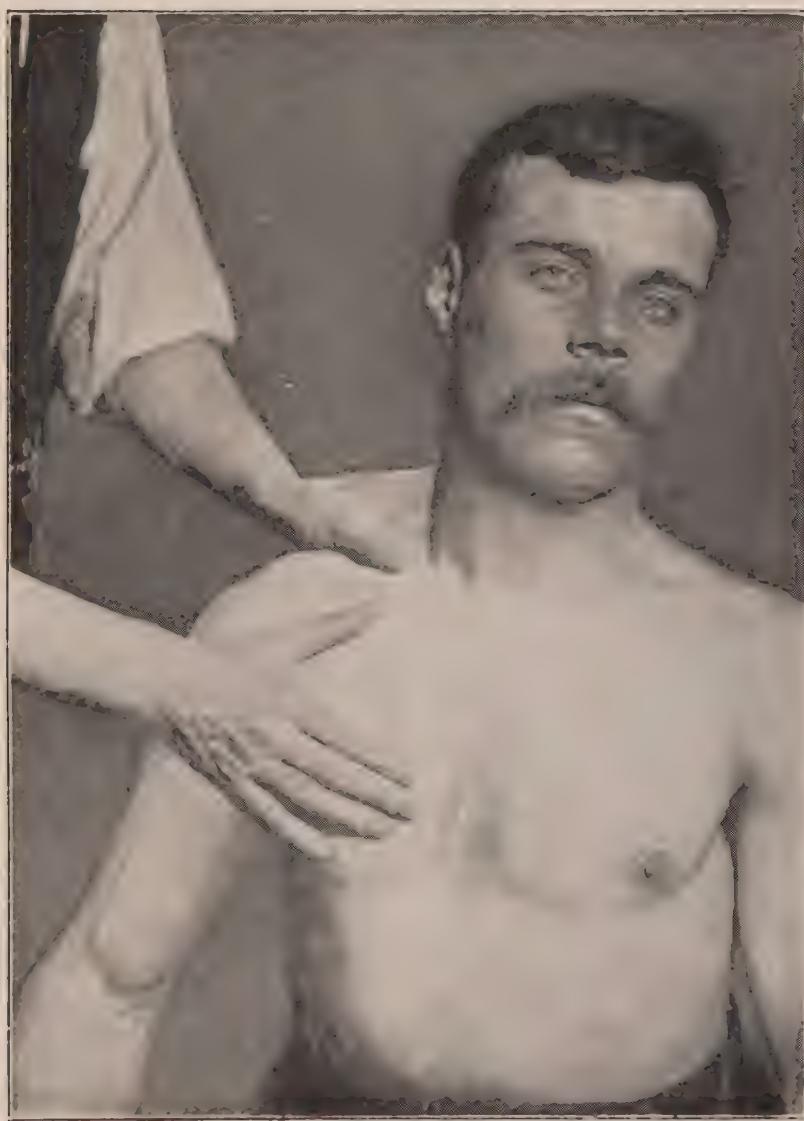


FIG. 55.

Local massage with the two thumbs after fracture of the Clavicle.

lation is necessary it may be performed painlessly. All movements of elbow, wrist and fingers are performed, and a large white linen sling is applied, with a turn of bandage to fix the arm

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to the trunk if necessary. The fore-arm and hand are left free in order that the patient may practise all movements without hindrance. Sometimes an axillary pad may give a sense of comfort. If there is mobility, it is necessary to take some further precautions and adhesive



FIG. 56.

Wharton Hood's strapping for a fractured Clavicle seen from in front. It is well to place a very thin layer of cotton wool over the skin in the neighbourhood of the fracture to facilitate removal, though soaking with acetone is almost equally efficacious.

plaster should be applied. Dr. Wharton Hood's device is as satisfactory as it is ingenious. "Three strips of firm adhesive plaster, each an inch and a half in width, should be applied, from a point immediately above the nipple to

a point two inches below the angle of the scapula. The middle strip should cover the seat of fracture and should be first applied." (See Figs. 56 and 57.) It is astonishing



FIG. 57.

Wharton Hood's strapping for a fractured Clavicle as seen from behind.

how firmly such a contrivance can control the fragments; but a useful auxiliary may be used, should the control still seem inefficient, in the form of a padded stirrup placed

over the point of both shoulders and fastened together behind them with a strap and buckle, in the manner recommended by Cheyne and Burghard. Massage is, of course, readily practised over the plaster.

Mobilisation must be administered to every joint in the limb, the movements at joints below the elbow being performed voluntarily if possible. The fingers must never be neglected.

If there is little tendency to displacement, underclothing is cut so that everything may be put on coat-wise ; the patient is dressed and allowed such freedom of use of the hand and fore-arm as does not entail raising the elbow from the support of the sling. (See Fig. 58.) In a week he is allowed to take the arm from the sling freely and perform any underhand movements not involving the raising of heavy weights. "Underhand movements" may be interpreted freely ; the patient might even ride or hunt at the end of a week. Exceptional strain, such as is entailed by rowing, must be avoided, but any ordinary pursuit may be followed without hesitation. In a fortnight exercises are commenced, and in three weeks full use is allowed provided no laborious work is undertaken.

If there is tendency to recurrence of deformity

similar treatment should be prescribed and a large safety-pin should be fastened through both layers of the sling on to the outer clothing just above the fore-arm so as to limit its movement. Under no conditions should a man be allowed



FIG. 58.

Arrangement of sling after fracture of the Clavicle. Note that the safety-pin inserted through both layers of the sling, and, if necessary, into the clothes beneath, limits the amount of possible movement to any extent the practitioner may deem advisable.

to wear a jacket without putting his arm through the sleeve. Such an arrangement always leads to downward pressure on the point of the shoulder which is liable to cause more serious displacement than any amount of movement involved in undressing. The patient is

advised to lie flat on his back as much as possible. This treatment occupies the first week, after which treatment proceeds on the lines laid down for fractures without displacement, the total duration of convalescence being thus increased by about a week.

The exercises mentioned are all of the simplest character. The first week, as a rule, and the second week if there has been free mobility, is occupied by such exercises as can be performed with the elbow still supported by the sling, movement of shoulder and elbow being carried out through small amplitude after massage. During the next week these movements are allowed at home provided no extra strain is put upon the fracture. There may be free use of all underhand movements ; also the exercise of grasping one side of a roller-towel low down with the hand of the injured side while the opposite hand seizes the other side of the towel high up and proceeds to draw it slowly down and up, thus raising the injured limb and, at the same time, supporting its weight. From the tenth day onwards this exercise is replaced by the pulley and weights, light at first but gradually increasing.

The whole course of treatment after massage has been applied for the first time is painless,

and an intelligent patient will regulate the progress of the exercises better than his adviser if warning is given to avoid all pain.

In children under ten the sling is applied next the skin, and it is necessary to insist on the use of shawls and wraps to clothe the upper part of the body unless the clothes can be so arranged as to exert no pressure. Movement is performed daily, and at the end of a fortnight the child may be dressed, the sling being fastened to the outer clothing as described above. In three weeks freedom is allowed unless the child is of an age at which falls are frequent, in which case it is wiser to wait for another week.

If it is essential to reduce deformity to a minimum, treatment should proceed as above for four days, after which the "absolutely recumbent" position must be maintained for a week. Union will then be quite firm enough to allow of progress on ordinary lines.

To summarise the treatment and prognosis, all cases require daily massage and mobilisation for at least a fortnight. Children should not be allowed the use of the injured arm for a fortnight; though an adult may, as a rule, use the arm from the outset. In three weeks functional utility should be restored for the

ordinary usages of daily existence. No weight should be carried for a month, and an extra fortnight will be needed before return to any laborious occupation. A striking feature in the history of all cases will be found to be the entire absence of pain from the moment that massage is commenced.

In my notes of cases it may be noticed that the persistence of some deformity is almost invariable. This is due to the fact that the fracture is always subcutaneous: some excess of callus is invariably present and must therefore show upon the surface. Excess of callus undergoes gradual resorption, rapid at first and continuing more slowly during the course of two years. My earlier cases as a rule presented actual alteration in the relationship of the fragments; among the later cases, in which massage treatment has been carried out as fully as time would allow, are many in which such deformity as persisted was due solely to callus and might therefore be reasonably expected to disappear.

Little remains to be said of the treatment of fractures at either extremity of the bone. Fear of deformity being minimal, they should be treated as described above, but with somewhat greater freedom. Use of the limb may be

allowed from the outset, limited only by the occurrence of pain. Three weeks should certainly witness the return of full functional utility. Even the strapping may be discarded, the use of apparatus being reduced to a simple sling for the first week.

These fractures may easily escape diagnosis, but a point of maximum tenderness on the surface of the bone is diagnostic.

Although there is little displacement, fracture of the inner extremity of the bone is most intensely painful, and the swelling is always great. Prof. Lucas-Championnière advises a very free use of lubricant. I have not found it necessary. Massage is in this instance best conducted by the use of the two thumbs near the region of fracture, whereas in case of fracture occurring near the outer end the use of the palmar aspect of the fingers held close together, or even of the whole hand, will prove more efficacious.

These cases of fracture of the inner extremity occasionally present really sensational features. A patient arrives suffering great pain and with a useless limb. Twenty minutes later he is free from pain, can perform all movements with freedom, if not with completeness, and pronounces himself to be "cured." Professor Lucas-

Championnière also draws attention to these sensational "cures."

Occasionally fracture of the inner end of the bone is complicated by anterior dislocation of the sterno-clavicular joint. If the case is seen early the dislocation may be readily reduced after massage. Later, reduction is very difficult, and at the best there is always a marked tendency to recurrence. If the dislocation can be reduced, an attempt should be made to retain the fragments in position. Treatment, except for this additional safeguard, is in all respects similar to that for fracture without dislocation. Persistent dislocation is a matter of small importance: it is inelegant, but, assuming proper treatment, it detracts little from the value of the limb.

## CHAPTER XXIV

### FRACTURES OF THE SCAPULA AND RIBS

#### FRACTURES OF THE SCAPULA

THESE comprise :—

1. Fractures of the Acromion and Spine.
2. Fractures of the Coracoid.
3. Fractures of the body.
4. Fractures of the anatomical neck.
5. Fractures of the surgical neck.

#### *Classical Treatment*

For fracture of the body of the Scapula Cheyne and Burghard recommend a starch bandage encasing the arm, fore-arm and trunk, to be left in position for two weeks.

Fracture of the Acromion would be treated most efficiently in the recumbent position with the arm at right angles, but, this being too irksome, they recommend pushing the head of

the Humerus upwards and fixing it there for a month with the arm flexed across the chest. "A certain amount of deformity persists," in many cases, but "gives rise to no real disability."

For fracture of the neck of the Scapula they recommend a similar position for four or five weeks, stating that if the apparatus is removed earlier "the deformity is almost certain to recur." Passive movements must be undertaken "after the lapse of about a week."

Fracture of the Coracoid is to be treated by the use of apparatus similar to that employed for fracture of the Clavicle unless there is much displacement, in which case operation will be necessary.

The text-books add nothing of interest, except that Holmes and Thomson and Miles refer to the frequency of fibrous union after fracture of the Acromion.

### *Massage Treatment*

Fractures of the Acromion and Spine resemble fractures of the Clavicle so closely that nothing further need be added except that union is somewhat more tardy. Bony union may be expected whenever treatment by mobilisation and massage is employed. Any permanent deformity should be discernible only on close inspection. It is

said that the Acromion epiphysis rarely unites after separation : perhaps massage may enable us to modify this statement. The accident may occur up to the age of twenty-four.

Fractures of the Coracoid require similar attention, diagnosis being well-nigh impossible without the use of the X-rays. It may be suspected, however, if pressure over the tip of the process causes intense pain ; but the pressure is always painful even under normal conditions.

Fractures of the body of the Scapula may be treated as if the condition were merely one of severe bruising, though injury to the subjacent ribs may add gravity to the accident. There is never any serious displacement, and such as may be present is of no importance.

Diagnosis is possible only when some irregularity of outline can be detected. Crepitus may be felt, as a rule, as soon as pain and spasm have been relieved. It is, however, of no importance, as the treatment advised is the most suitable in the presence or absence of fracture.

Massage and movements should be prescribed daily, and the patient should be provided with a sling ; but perfect freedom, limited only by pain, may be allowed from the outset.

The massage applied should be precisely similar to that prescribed for fracture of the

Clavicle, special attention being given to the region of the spinati muscles. (See Figs. 23 and 24.) Massage should always be directed towards the spine and somewhat outwards. The patient should be encouraged to assume a "slouching" position. All movements are administered daily, except that the arm should not be carried backwards during the first week. During this time a sling should be worn ; and warning must be given against abuse of freedom.

Three to four weeks should suffice, as a general rule, for complete restoration of function after any of these three fractures. If the body of the bone is broken the simultaneous injury to the tissues may be so severe that convalescence is slower, and complete recovery may be postponed another fortnight or three weeks, but this delay is irrespective of the bony injury.

I have not had the opportunity of treating fractures of the anatomical or surgical necks of the Scapula or fractures involving the glenoid cavity, and no special mention is made of such fractures by Professor Lucas-Championnière. All exhibit prominence of the Acromion with flattening of the shoulder if there is displacement. The arm is lengthened and the general

appearance strongly resembles dislocation. The arm, however, hangs straight down and the shortening is readily corrected by raising the elbow, recurring again as soon as support is withdrawn. Crepitus will probably be felt.

Treatment by massage and movements would be in no way contra-indicated, and that prescribed for fractures of the surgical neck of the Humerus should suffice with slight modification.

The treatment should be carried out with the patient recumbent and the sling should be so arranged that full support is given to the elbow in contra-distinction to the arrangement advised for fractures of the Humerus, where the main support is applied to the distal end of the fore-arm.

Union, moreover, would probably take place more slowly ; and support at the elbow would be required for three weeks, by which time a limited freedom of the whole arm might be allowed. The sling could be discarded after another week and recovery should be complete at the end of six weeks, laborious work being allowed a fortnight later. In the absence of displacement, of course, treatment might be advanced more rapidly.

## FRACTURES OF THE RIBS

I have never yet practised massage throughout the treatment of these cases, having only done so on the patient's first visit to determine whether the pain could be relieved. The result has been most encouraging.

Were treatment by massage to be carried out, the strapping would be applied as usual, since it affords the patient a sense of comfort and security, and over this massage could be practised. There is a tendency to apply the strapping too transversely: the obliquity of the strips should reach nearly  $45^{\circ}$ , their breadth should never exceed two inches, and they should overlap the mid-line both in front and behind, being applied in forcible expiration. (See Fig. 59.)

I believe that massage for fifteen minutes each day for ten days (when the strapping might be replaced by a flannel bandage) followed by less skilled rubbing for another ten days would result in an almost painless recovery, provided that no strain was exerted by the pectoralis major and serratus magnus muscles during the early stages. The pain which so often persists at the site of fracture, long after union is complete, is a most disheartening sequel to ordinary treatment.

From what we know of the effect of massage on other fractures it would seem reasonable to



FIG. 59.

The application of strapping for a fractured rib. Note that the position of the patient is correct, but the obliquity of the strapping is insufficient: also that the lower edge is "rolled" at its lower border because the strapping is too wide.

expect that this might be eradicated by the routine use of massage. The direction of the movements must be from behind forwards. The

palm of the hand is used to massage the whole of the affected side of the chest, and treatment terminates with the use of the two thumbs in the neighbourhood of the fracture.

Mobilisation, scientifically prescribed for the arm, would be of the greatest value.

## CHAPTER XXV

### FRACTURES OF THE BONES OF THE LOWER EXTREMITY

#### *General Considerations*

TREATMENT of these fractures presents various features which require to be dealt with somewhat differently from cases of fracture occurring in the upper extremity.

The fractures are usually more severe, and the fragments are liable to suffer greater displacement, while the periosteum suffers injury to a corresponding extent. The weight of the body continuing to act on the broken bone, when solution of continuity takes place, is responsible for these grave effects in many cases ; while in others they are due to the weight of the limb acting on the site of fracture. A third most potent factor is to be found in the arrangement of the various muscular attachments. The muscles are very powerful, and it is often found

that the insertions of a muscle and its antagonist are separated by a wide interval. Thus, after supracondylar fracture of the Femur, the most powerful muscle attached to the lower fragment is the gastrocnemius on the posterior aspect, while its antagonists act only on the Tibia. After fracture, therefore, when all the muscles are in spasm, the lower fragment of the Femur is tilted backwards.

After fracture in the upper extremity it is possible to allow a comparative freedom before consolidation is well established, but the extra weight of the lower limb alone would postpone such freedom. Further, it is possible to allow a certain freedom of functional utility to the upper extremity which must be withheld from the lower extremity as regards its main function, the support of the body-weight, until such a time as union may be perfectly restored.

It would seem, then, that massage treatment would be of small value in these cases, but the reverse is the fact.

It is always possible to relieve pain.

It is often possible to effect reduction of a deformity under the influence of massage (which would have resisted reduction by other means even under deep anæsthesia), and thus to avoid some operative interference, if only tenotomy.

It is possible to maintain the fragments in position by means of the simplest splints, where a complicated apparatus might well fail to do so had forcible reduction been utilised unfollowed by massage.

It is possible to promote the rapidity of repair ; to prevent the formation of adhesions ; to minimise, or even prevent, the wasting of muscles ; to maintain the suppleness of the joints ; and finally, when union is sufficiently firm to support the body-weight, to leave the patient in possession of a limb which is perfectly healthy in all respects. Such after effects as stiff joints, painful callus, obscure pains, troublesome oedema and muscular weakness may all be eradicated.

In other words, when massage and mobilisation is the treatment employed, the limb is in a normal condition as soon as union is sufficiently firm to allow the patient to walk, instead of being a weak, stiff, wasted parody of its former self, full of obscure aches, swollen and oedematous.

Functional utility must be restored at an early date. To this end may be employed, and that long before it is wise to allow the patient to walk, the simple contrivance of a rowing “sliding-seat.” The rollers run on an inclined plane. If the inclination can be altered the

## 390 TREATMENT OF FRACTURES

exercise can be regulated to a nicety ; if not, much can be done by an arrangement of pulleys and weights, which serve the purpose of oars in adding resistance to the “leg-drive.” (See Fig. 60.) A suitable apparatus can be devised at an outlay of a few shillings. Such exercises will be spoken of later as “exercises without weight.” A stationary bicycle affords opportunity for similar exercise.

Another exercise without weight which is often of value for fractures below the knee and entails no outlay, is performed by the patient sitting on a chair with his foot resting flat on the ground, the buttock of the injured side somewhat over-hanging the edge of the chair. The foot is raised and moved forward an inch or so and placed flat on the ground. It is then raised and placed flat some inch behind its original position. The distance is gradually increased until it is found impossible to make toe and heel touch the ground simultaneously. The exercise is then repeated.

Long before any weight may be borne on the limb every joint may receive its dose of active movement. It is performed under the best conditions if the patient is allowed to sit on the side of a bed and hang the foot down. Full exercise may then be allowed to the knee,



FIG. 60.

The sliding seat in the Physical Exercise Department of St. Thomas' Hospital in use. The remainder of the apparatus shown enables patients to practise every conceivable exercise with the weight and pulley.

and all movements of the foot and ankle, with limitations according to the nature of the case.

The next advance is to place some weight on the leg. This may be done by partially supporting the weight of the body on crutches ; though the most satisfactory method, perhaps, is to encourage the patient to walk along pushing



FIG. 61.

a chair in front of him, while resting a portion of his weight on the back of the chair.

As soon as weight can be borne on the limb five exercises may be prescribed.

- (i) Feet at "attention," rise on tip-toe, and return.
- (ii) Feet parallel and three inches apart, rise on tip-toe and approximate the plantar aspects of the heels, and return. (See Fig. 61.)

(iii) Feet together, raise toes, and return. (See Fig. 62.)

(iv) Feet together, rotate feet outwards until the weight is borne on their outer side, and return. (See Fig. 63.)

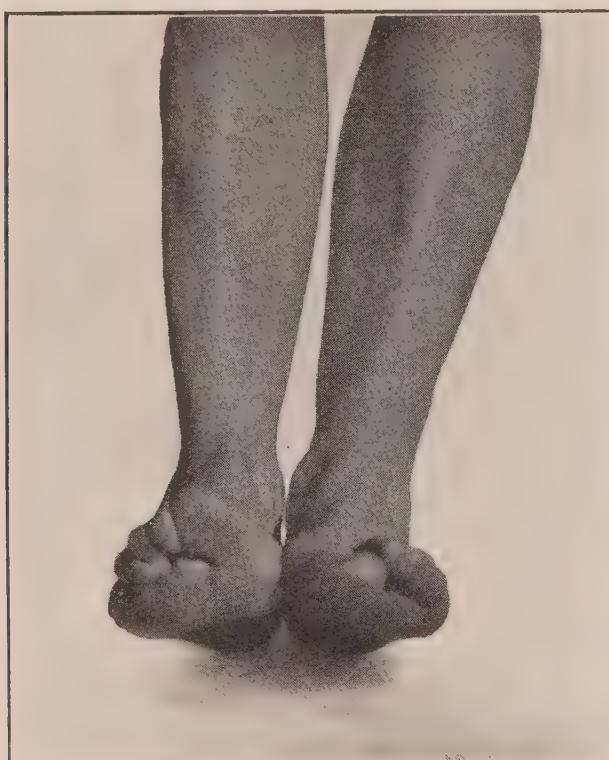


FIG. 62.

(v) Toes together, heels apart : raise heels and return. (See Fig. 64.)

(vi) Supplement (i) by sitting down on heels, return to tip-toe and then to original position.

It is often well at first to advise the patient to steady himself by grasping the side of a table while going through his exercises.

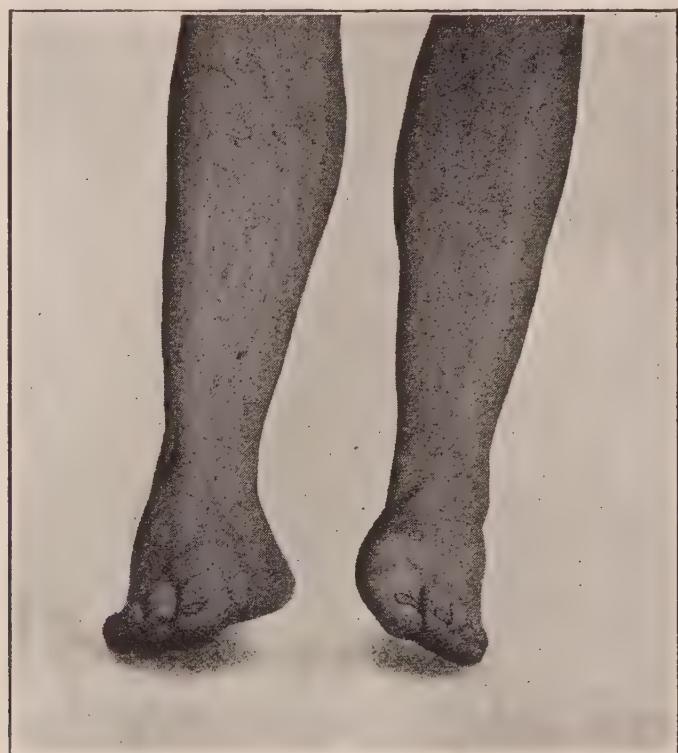


FIG. 63.

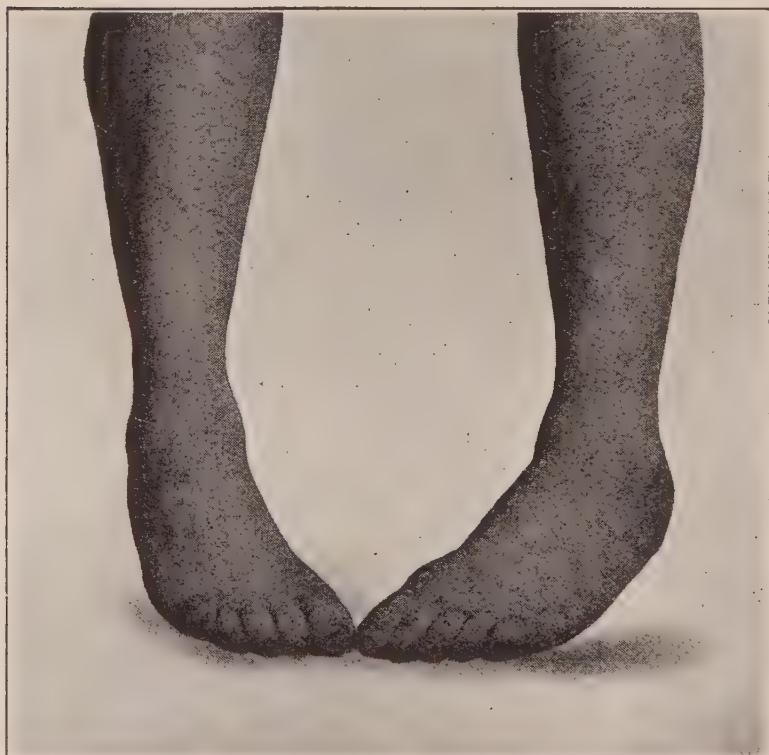


FIG. 64.

In many cases treatment of fractures of the lower extremity by massage must be deferred for a few days during which the fragments are immobilised. A single preliminary *séance* will prove of great value in these cases, and after eight days of immobilisation the treatment can usually be proceeded with. As a rule, however, the fractures for which massage treatment is of paramount importance, that is to say, when a joint is involved, are also those which require a minimum of immobilisation, while in many cases massage may be practised regularly from the outset.

## CHAPTER XXVI

### FRACTURES OF THE FIBULA

THESE include :—

- (i) Fractures of the upper extremity ;
- (ii) Fractures of the shaft ;
- (iii) Fractures of the lower extremity,
  - (a) without displacement,
  - (b) fracture-dislocations ;
- (iv) Separation of the lower epiphysis ;
- (v) Fracture of the tip of the external malleolus.

#### *General Considerations*

Fractures near the head of the bone require no special notice except in so far as they are liable, in rare cases, to be associated with injury to the external popliteal nerve giving rise to the condition of foot-drop. They are treated like fractures of the shaft, but the knee-joint may

require careful treatment on account of concomitant traumatic arthritis.

Separation of the epiphysis and fracture of the lower end without displacement call for special consideration owing to the neighbourhood of the ankle-joint, and fractures of the tip of the external malleolus should receive very similar treatment.

Fracture-dislocation, *e.g.* Pott's fracture, must be considered separately. A twist of the foot which causes fracture does not of necessity involve the ankle region. Such a twist with the foot extended may cause an oblique fracture of the upper third of the Fibula.

### *Classical Treatment*

Fracture of the shaft of the Fibula alone requires a Croft's splint for a fortnight according to Cheyne and Burghard. The ankle must be moved daily. The patient may be allowed to walk in "four or five weeks' time." All fractures of the lower end of the bone are classed as fracture-dislocations.

The other text-books dismiss the consideration of fractures of a single bone of the leg by stating that the treatment should be similar to that for fracture of both bones where there is little tendency to displacement. Such treatment

must inflict much unnecessary hardship on the patient. Holmes recommends the use of plaster for six weeks in all cases.

### *Massage Treatment*

In fractures involving the lower third of the Fibula without displacement the bony injury, as in fractures of the lowest inch of the Radius, is trivial, the injury to other structures alone demanding attention. It is to the latter, therefore, that the major part of treatment is applied. Fractures of the shaft would require no treatment were it not for the pain and swelling, and a possibility of non-union. It must also be borne in mind that few fractures of the shaft of the bone are unaccompanied by traumatic arthritis (slight though it is, as a rule), originating simultaneously with the fracture, in either knee or ankle.

All fractures of the lower extremity where there is any tendency to displacement must be treated as reduced fracture-dislocations. Contrary to the usual teaching, a vast number of these fractures occur where such tendency is absent. If the accident which causes fracture fails to cause displacement, it is a fair presumption that the treatment about to be described will also fail to do so.

Let us therefore consider the treatment of a fracture when deformity is absent.

Diagnosis is based on the history, the presence of pain and the finding of a point of exquisite tenderness on the bone. Presence of echymosis is almost diagnostic, as it rarely follows a simple sprain immediately. Loss of function may be absent. There is an old and true saying that if the patient is able to walk after accident it is probably a case of fracture, if he is unable to do so it is probably a case of sprain, provided, of course, that deformity is absent.

Attempts to establish crepitus or the absence of the so-called "fibula-spring" must entail risk of causing unnecessary displacement. The same applies to all forcible movements of the foot.

Too much stress must not be laid on the history, as the patient will ascribe a fracture to the circumstances which caused a fall rather than to the fall itself.

It is well to examine the region of the internal lateral ligament. The presence and nature of pain in this position affords a reliable guide as to the presence of deformity should the swelling be so great as to obscure the bony outlines. If pain is slight or absent there is no displacement, but pain may be severe even in the absence of displacement.

If doubt still exists as to the presence or absence of fracture the foot may be *gently rotated inwards*. If this causes pain at the site of exquisite tenderness, or of maximum pain, diagnosis is established. Under no circumstances should any attempt be made to lateralise the foot or to rotate it outwards.



FIG. 65.

A position for massage of the leg when there is no liability to displacement, or when union is complete.

Massage may be required to assuage pain before diagnosis is possible if the fracture is of some standing.

The most convenient position for treatment of all fractures of the leg is the recumbent, but it is essential that the bed or couch should not be too soft. An excellent position for treatment is obtained by the patient sitting on the couch and

allowing the injured limb to rest on the practitioner's thighs, which may easily be adjusted to give suitable support to all varieties of cases. This arrangement overcomes the difficulty of allowing the weight of a large portion of the leg to rest on the prominence of the heel. (See Fig. 66.)



FIG. 66.

A second position for massage of the leg. A third position is shown in Figs. 8-10, p. 140.

65.) Another method is to allow the injured limb to rest in the hollow caused by the closure of the two thighs across which a towel has been stretched. (See Fig. 66.)

It is wise to commence massage with the whole of the palmar surface of the hand and fingers embracing as much as possible of the limb. Pain is soon relieved and then the actual

neighbourhood of the injury may receive attention from the two thumbs, care being taken to avoid all pressure over the actual site of fracture. The necessity of applying massage to the dorsum of the foot and ankle must never be overlooked, even if the fracture involves the upper third of the bone. The movement "en meule" may be used with advantage after the first week, if there is much swelling, and the massage should terminate with a final dose of the original movements. Each of the movements should occupy about five minutes, but the first must be continued until pain has disappeared, although it will seldom be found necessary to prolong this stage of treatment beyond ten minutes.

A fractured Fibula may present itself under one of two forms, being characterised either by great pain or by great swelling. There is apparently no law connecting either condition with any particular site of fracture, although it may be said that, as a general rule, fracture of the upper third of the bone is extremely painful, while fracture near the lower extremity is characterised by great swelling on the dorsum of the foot. The site of pain may be, according to Professor Lucas-Championnière, either the ankle or the actual fracture ; but unless there has been sufficient displacement to lead to severe lacera-

tion of the internal lateral ligament the ankle pain would seem to be insignificant, or, at least, readily amenable to treatment. In cases where this pain is a marked feature an extra ten minutes should be devoted to the region of the ankle. If the fracture involves the upper third of the bone, the knee-joint may require this extra attention instead of the ankle. In this case the thigh should also receive its dose of massage.

As soon as massage has effectually relieved all pain, movements should be administered to the joints, each toe in turn receiving attention. All movements of the ankle follow, but care must be taken to avoid all such amplitude as will give rise to pain. If the patient is in bed, the knee and hip must receive their dose of mobilisation in all cases.

In the treatment of the fractures under consideration no splint is necessary, a flannel bandage, loosely applied, being all that is required. The weight of the bed-clothes should be supported by a cradle. The patient may be allowed to get about freely on crutches, but should be advised to keep the foot well raised when sitting down, at any rate during the first week.

As soon as the swelling has disappeared, or is markedly declining, and pain has not been

noticed for three days, exercises without weight may be prescribed. This stage will usually be reached with the termination of the first week of treatment.

About three days later, if the exercises are well performed without pain, the patient may be encouraged to place some weight on the foot while supporting the bulk of his weight on crutches.

By the end of a fortnight he may be allowed to begin to walk about the house with a stick, but out of doors he should not be allowed to do so until a boot can be worn with comfort. Care must be taken to ensure that there is no pressure on the site of fracture which might irritate the newly-formed callus. Such irritation renders the callus "sensitive," recovery may be greatly delayed on account of pain, and suspension of treatment may possibly become necessary if the irritability is marked. The simpler of the exercises which have been described may be ordered. By the end of the third week the patient may freely indulge in walking exercise, and the remainder of the set exercises may be prescribed. Massage should be applied daily up to this point.

At the end of the fourth week treatment may be abandoned in all but very exceptional cases.

A labourer or sportsman will require a fortnight's walking exercise before it is wise for him to resume his avocation. Football and similar sports should be postponed for another two to four weeks.

The most suitable exercise for regaining full strength is bicycling, which may be freely indulged in after the third week. The ex-patient must be careful about dismounting.

Many patients will be found to have been "walking about a little" throughout treatment, beginning sometimes on the second or third day. They never seem to be any the worse, but the practitioner who allows such an early return to the normal functions of the limb takes upon himself a somewhat grave responsibility in the not unlikely event of the occurrence of a second accident. Failing this, no harm will be done.

If the fracture involves the upper half of the bone, there is no reason why walking should be prohibited, provided it causes no pain, as it will not after three or four days.

Except where a limb has been treated by immobilisation I have never seen any evil after-effect as the result of a broken fibula ; though it is often stated that massage treatment in the hands of quacks and bone-setters has been

responsible for all manner of troubles. This may be the case: if so, it is not the treatment that is at fault but the technique; and we have another example of the danger of entrusting the treatment of fractures by this method to those whose knowledge is confined to the ordinary methods of massage.

I have examined two cases of fracture of some years' standing in which X-ray examination showed the presence of false joints in the Fibula, both involving the middle third of the bone. The cases, originally fractures of both bones of the leg, had been treated by prolonged immobilisation. The condition was discovered accidentally in both cases. In neither case had there been any interference with the normal functions of the limb, and tendency to deformity in the ankle region was entirely absent; it being thus seen that there need be no fear of deformity resulting from too early use of the limb after fracture above the lower third of the bone. If the precautions indicated are carried out, the chance of deformity occurring as the result of fractures in other situations is equally remote.

Separation of the epiphysis and fracture of the tip of the malleolus require similar treatment.

## CHAPTER XXVII

### FRACTURES OF THE TIBIA

THESE include :—

- (i) Fractures of the condyles ; including T-shaped fractures ;
- (ii) Fractures of the head, the so-called “compression fractures” ;
- (iii) Fractures of the tubercle ;
- (iv) Separation of the upper epiphysis ;
- (v) Fractures of the shaft ;
- (vi) Fracture of the internal malleolus —“Waggstaffe’s fracture.”

#### *General Considerations*

The first two groups may be considered together from the point of view of treatment. Instances are very rare.

Fracture of the tubercle calls for no consideration here. If possible the fragment must be pegged down, or, should the rest of the bone

have suffered too severely to allow this, the fragment must be fixed as well as may be possible. Failing this massage should be adopted : it is impossible to say, without experience, what result might be expected.

Separation of the upper epiphysis, if displacement is serious, calls for reduction under an anæsthetic with subsequent massage. The treatment then coincides with that of the first two groups.

A special form of partial separation has been revealed as the result of X-ray examination. The patient is usually in these cases a boy, say about twelve years old. There is commonly a history of a trivial accident which, occurring some time previously, was probably so slight as to be ignored, but which has been followed by slight pain. A lump is then noticed to be forming below the knee. On examination this is found to consist of callus formed at the junction of the spinous element of the epiphysis with the shaft. It has often been diagnosed as tubercular disease. X-ray examination reveals that the whole epiphysis has undergone a very minute degree of tilting backwards. The accident is of little more than pathological importance. Rest, massage and movements for a week, followed by a few simple

exercises, will cure the present obscure pain, and no future inconvenience need be anticipated.

Fractures of the internal malleolus require treatment similar in all respects to that suggested for fracture of the external malleolus : if there is displacement it is well to consider the case as one of fracture-dislocation.

### *Classical Treatment*

Cheyne and Burghard divide fractures of the upper end of the Tibia into three classes :—

(i) "Compression fracture," where the head of the bone is comminuted, requires an anæsthetic and extension. Massage and movements are begun in a fortnight. A Croft's splint is re-applied daily after three weeks.

(ii) Fracture of the spine of the tibia will require operation.

(iii) Transverse fracture or separation of the epiphysis is treated by a Croft's splint, but the duration of treatment is not specified.

They recommend a MacIntyre's splint for fractures of the shaft of the Tibia, though a box-splint may be needed if blisters are present ; to be followed by a Croft's splint. The splintage is continued for six weeks. In case of comminution similar treatment is carried out, but

“special care should be taken to see that the union is firm before the patient is allowed to get about.” When union is likely to be considered firm we are not told.

In fractures of the malleolus only, a Croft’s splint is used for a fortnight with massage and movement daily from the first. “Union takes place readily” comprises the rest of treatment and prognosis.

Rose and Carless offer little further advice, except to issue the warning that fracture of the internal malleolus may unite by fibrous tissue, and, in any case, “usually in a more or less abnormal position, thus interfering with the integrity of the ankle-joint.”

Thomson and Miles only add one piece of information, namely, that “for some unexplained reason (fractures of the head of the Tibia) take a very long time, sometimes several months, to unite.”

Holmes does little more than mention these fractures, confining his attention to fractures of both bones.

#### *Massage Treatment*

Diagnosis, owing to the large subcutaneous area of bone, is rarely difficult.

Fractures involving the head of the bone may

present difficulties in diagnosis, as the swelling is rapid and intense. X-ray examination may be necessary, but it is of little importance in practice to form an accurate diagnosis. Displacement is very slight and is readily corrected by administering a full dose of mobilisation after the first massage treatment. If there is no impediment to movement, there is no persistent deformity in the joint surfaces, and any deviation below this will be discovered if of sufficient importance to need correction. The traumatic arthritis will furnish a more grave condition than the bony injury, and the case will require treatment on similar lines to those suggested for treatment of fractures involving the elbow joint. The essential part of treatment would be to administer a free dose of mobilisation the first day, and thereafter very minute doses very gradually increased. A MacIntyre's splint would probably prove most suitable. Full movement should be attained in about a fortnight, exercises without weight should be begun a week later, and walking might be commenced in about a month. With massage treatment there would be no reason to fear delay of union. Such delay is supposed to occur with T-shaped fractures of the lower end of the Humerus, and we have seen that this may be prevented by

massage. There is no reason for supposing that massage would not be equally successful in the same direction in the case of the fractures under consideration.

The whole limb will require massage: hip and toes must receive their dose of mobilisation and the ligaments of the knee must receive careful and individual attention, so far as is compatible with avoidance of the actual site of fracture. The common practice of "circling" the Patella with one thumb is strongly to be deprecated. The movement has no scientific justification and is very irritating. The massage movements near the Patella should be centrifugal.

The treatment of fractures of the shaft of the bone resembles very closely that soon to be described for fractures of both bones of the leg. The only difference is that the fractures are nearly always due to direct injury: they are therefore transverse, and there is no tendency to displacement. The treatment is therefore modified in that mobilisation may be advanced with greater freedom. At the end of a week the patient is allowed to swing the leg about and practise circumduction of the foot. During the second week exercises without weight are prescribed, in three weeks a certain amount of weight may be borne on the foot, and at the end

of a month the patient should be able to walk about with freedom.

It will, as a rule, be wiser to provide the patient with a plaster splint on the second or third day. It may be applied without an anæsthetic, as it need not be too rigid or exact, and it is removed every day for massage. Its use is abandoned at the end of a fortnight.

If the fracture occurs near the lower end of the shaft, there will be a marked traumatic arthritis of the ankle, which will call for treatment similar to that prescribed for fracture of the lower end of the Fibula ; while if the lower end of the bone is badly comminuted, it is wise to consider the case as one of fracture-dislocation.

## CHAPTER XXVIII

### FRACTURES OF BOTH BONES OF THE LEG

#### *General Considerations*

THESE consist of two great varieties, viz.: transverse fractures, occurring at the same level and due to direct injury, and oblique fractures, due to indirect injury in which the Tibia yields at its weakest point, the junction of the middle and lower thirds, the fracture of the Fibula occurring somewhat higher. The latter class frequently shows fracture of the Tibia of the "en-bec-de-flute" and other forms of the spiral type.

Should the line of fracture on the subcutaneous surface of the Tibia be V-shaped it is said that a fissure invariably runs down into the joint along the back of the bone, a complication which is supposed to add to the risk of subsequent stiffness and impaired usefulness of the limb. Such a fissure is, of course, of no consequence if

treatment by mobilisation and massage is employed, though it may well be of great importance if the limb is immobilised.

### *Classical Treatment.*

Much space in all the text-books is allotted to the treatment of these fractures.

For fracture through the shafts of both bones of the leg a Croft's splint should, according to Cheyne and Burghard, be kept on for at least six weeks, though the patient may be allowed to leave his bed after four weeks. Operation is frequently called for, in which case massage should be commenced after the first fortnight.

Rose and Carless refer very early to the possible desirability of tenotomising the tendo Achillis in order to effect reduction. Operation is urged somewhat strongly, but otherwise any suitable splint may be applied for two or three weeks, to be followed by at least another month of plaster: "even then a good deal of stiffness is likely to persist."

Thomson and Miles, however, recommend a great advance in treatment. For fractures of the lower third they suggest an "ambulatory plaster splint." In other cases massage is to be employed as early as possible, and the ankle is to be moved from the first. In three weeks the

patient is to be allowed up in some simple splint, and may begin to use the limb in six or eight weeks ; though if the fracture is oblique, comminuted, or compound, three or four months' treatment may be necessary. They conclude by saying : "We do not share in the dissatisfaction . . . . as to the results obtained by non-operative means in these fractures, and do not recommend a systematic resort to operative treatment."

Holmes says that "as a rule, when the fracture is simple, the patient recovers with no permanent disablement, though to this rule there are unfortunately numerous exceptions." Splints are applied for eight weeks before the patient is allowed to walk, the first four being passed in bed if possible.

### *Massage Treatment*

Diagnosis is almost invariably a simple matter : deformity is obvious and preternatural mobility is evidenced by the outward rotation of the foot. There should be no attempt to elicit crepitus. If diagnosis of the fracture is doubtful, it is certain that the periosteum has escaped any marked degree of tearing. Every precaution should be taken to avoid further injury. The pain may be relieved in five or ten minutes

by massage; and, as the spasm wears off, if crepitus is obtainable it is sure to be felt, and preternatural mobility will become evident. It is necessary that the foot should be supported by one hand while massage is applied with the other. Even if fracture of the Tibia is established, some doubt may exist after ordinary examination whether the Fibula has remained intact; but in the absence of muscular spasm the mobility of the lower fragment of the Tibia may, after massage, be shown to be such that the condition of the Fibula can be gauged with accuracy.

It now becomes necessary to reduce any deformity. Fractures involving the joint surfaces may be found to have suffered little displacement as regards the outline of the joints, when the application of a dose of mobilisation will ensure a perfect adaptation of the broken fragments of the Tibia, and then it will be seen that the Fibula has also recovered its natural contour. If there should be great displacement of the fragments which carry the joint-surfaces the case must be treated as a fracture-dislocation.

Fractures of the shafts may be attended by great displacement, the degree of deformity depending on the nature of the fracture. If due to direct violence the fracture is usually trans-

verse ; and, in spite of serious comminution, there is usually little displacement, the periosteum acting very efficiently as an internal splint. Fractures resulting from severe twisting of the foot present every conceivable variety of fracture, but here again it is common for the periosteum to survive the strain placed upon it without yielding sufficiently to allow grave displacement. But the most common fractures, those due to slipping, are oblique ; or, if the slip has led to a certain amount of torsion, of the spiral type. Then deformity may be grave and obvious, and the periosteum severely lacerated. The lower fragments incline backwards while the upper remain straight, the heel is drawn up and there may be various degrees of shortening. The foot is rotated outwards, a condition usually said to be due to its own weight. The deformity persists whichever way the leg is rotated, the foot cannot be raised into the vertical position by simply supporting its weight, and there is always resistance to any such attempt. It would therefore appear that the deformity is due to the spasm of the muscles, chief among which would be those of the peroneal group. The backward displacement of the lower fragment is admittedly due to spasm of the calf muscles and not to the weight of the foot ; and there is no evi-

dence to show that the outward rotation is due to weight rather than muscular spasm. Moreover, as soon as the spasm has been relieved by efficient massage the foot may be raised to the perpendicular without resistance and without pain, if the movements are carried out with patience and skill.

This provides the first indications for treatment. The patient being placed in a bed provided with a hard mattress or "fracture-boards," the sole of the foot of the injured leg is grasped by the corresponding hand of the practitioner (see Figs. 8—10, p. 140), and massage is commenced, special attention being paid to the region of the peronei. It is of no moment that the portion of the calf which rests upon the bed is unavailable for treatment, a sufficient area will present itself for massage to be effective without raising the limb. The leg is gently stroked ten or fifteen times a minute from ankle to knee. After ten minutes the hand which grasps the foot slowly begins to rotate it into position. It may be necessary to perform this rotation through an angle of some  $30^{\circ}$  or more. The movement should be continuous, and yet it should occupy at least five minutes, massage being continued the whole time. Combined

with the rotation a certain amount of gentle traction may be called for.

It can be said with perfect truth that the fragments may frequently be observed to drop into their natural positions; and at the end of twenty minutes the outline of the Tibia should be perfect. If it is not, it is a fair presumption that some mechanical obstacle is interposed between the fragments—usually a piece of muscle, occasionally a loose fragment of bone.

An “en-bec-de-flute” fracture may require some slight manipulation in excess of that described, but, as a rule, it is possible so to regulate the movements of the hand which grasps the foot that a slight increase of pressure judiciously applied by the other hand during the course of massage will suffice to correct the deformity. Occasionally it will be necessary to get an assistant to hold the foot while the fragments are manipulated into position. Only occasionally, however, will the massage anaesthesia prove sufficiently intense to allow of such manipulation without causing pain, the onset of which should instantly prohibit any further attempt. A general anaesthetic will then be necessary.

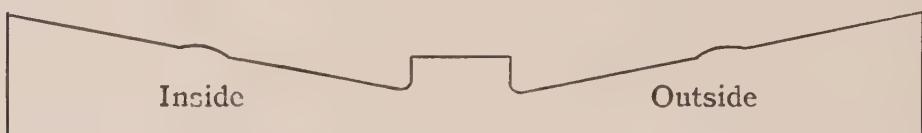
If the patient is to remain in bed the most

satisfactory splintage will be afforded by a Neville's splint. The two lateral boards must be fixed so that rotation is impossible, which is done by simply allowing their ends to overlap the perpendicular foot-piece, not using the straps, as is usual, as a sort of loose hinge round the end of the footpiece. When slung from the cradle the splint should be only just clear of the bed-clothes. The foot may be bandaged to the splint, but otherwise it is preferable to fix the whole apparatus by webbing. The bend on the splint behind the knee should be more accentuated than is customary with these splints.

Few cases, however, require to be kept in bed for any length of time, as a plaster splint will keep the fragments in position when once the spasm has been relieved by massage—usually about twenty-four hours after fracture—and there is no fear of further swelling. During the twenty-four hours two full doses of massage should be administered. The objection is that a general anæsthetic is essential.

Provided that two necessary conditions are observed it is immaterial how the splint is devised. It must, however, be freely open in front so as to be easily removable at an early date, and it must be open to some extent behind, to allow of the formation of a hinge. The

simplest plan is to cut the material in the following shape :—



appearing, when doubled, thus :—



the portion which is to clothe the outside of the leg being somewhat longer than that for the inside. The ordinary laws for applying a plaster must be observed, viz. :—

- (i) Foot at right angles to the leg ;
- (ii) Foot inverted to its full extent ;
- (iii) Head of first Metatarsal, internal Malleolus, and inner edge of Patella all in one plane.

The advantage of the Neville's splint is that massage may be performed daily, but it is imprudent to remove the plaster splint for from five to eight days. The time varies with the site of fracture ; the higher the fracture the shorter the period of immobilisation. This variation is partly due to the fact that fractures low down are liable to greater mobility ; but it must also be remembered that the area of cross-

section of the Tibia increases rapidly in the middle and upper thirds of the bone and that union is therefore more rapid. If, however, mobility of the fragments is poorly marked the splint may be removed after the shorter period, even if the fracture involves the lower third of the Tibia.

In any event the toes must be moved daily from the outset ; if a Neville's splint is used a slight dose of mobilisation may be administered to the ankle as well. After five days the limb may be raised from a Neville's splint or, in most cases, from the plaster for movements of the knee through  $30^{\circ}$  or thereabouts ; while minute movements of the ankle are performed in all directions.

A week later movements should have been advanced until they are full at all joints. The return of the functions of the limb is slow, and it is therefore important to remember that we have to rely solely on our treatment to maintain muscular strength and the suppleness of the joints. Even the hip should receive attention, and all movements must be performed with great frequency, though their amplitude is not important. It will be advisable to massage the thigh for a few minutes each day up to this point.

The massage during the first few days of its application should be confined to simple stroking for fifteen or twenty minutes, and must continue during the time the mobilisation is being administered. Thereafter somewhat more localised treatment may be added by the use of the two



FIG. 67

Position for local treatment of the outer side of the ankle-joint.

thumbs. Each group of muscles receives individual attention, as do also the ligaments of the ankle or knee (see Fig. 65); but the site of fracture must be scrupulously avoided, as the callus which is being formed subcutaneously is apt to become "irritable" as the result of direct pressure. It is no less

important to avoid direct pressure on newly-formed callus than on the site of fracture before callus has formed. Massage must be continued until the patient has been able to walk without a stick for at least a week. A few doses of massage later on may greatly expedite the return of full strength. They should be somewhat prolonged and administered at intervals of two or three days. The thigh should receive most attention during these auxiliary *séances*.

Each day the strength of union may be accurately gauged while the dose of mobilisation is being administered. It is usual to find that no movement takes place between the fragments within a fortnight of fracture, eight days usually sufficing for union of fractures of the upper third, ten to twelve days for union of the lower third. It is always quite easy to decide on which day union may be described as "complete." Four days later the use of splints is abandoned, and the patient is advised to hang the injured foot over the edge of the bed and swing it to and fro. Movements of circumduction are also practised. A few days later, that is about the end of the third week, the patient commences exercises without weight; and, if these are performed readily and without pain, he may be allowed to bear some weight on the leg a week

later—not more than a month in all after fracture.

At the end of another week one crutch may be discarded out of doors, and the patient can get about the house with a stick.

In six weeks the majority of patients will be able to walk about with freedom.

Such is a rough sketch of the course of an ordinary case; but the conditions vary to such an extent that it is impossible to lay down any definite rules. A child who is not likely to fall about, and many young adults, may often be allowed to walk with perfect freedom in a month: a stout, elderly patient may not be able to do so for two months. A transverse fracture will require a full week's less treatment than an oblique fracture: comminution adds at least a week to its duration. A simple fissure into a joint does not alter the prognosis, except in so far as it may be affected by the severity of a traumatic arthritis. Cases of fracture in the lower third of the leg should be allowed about a week more than those in which the upper end is involved before walking is permitted.

If a patient is unable to use his leg with perfect freedom in two months, or in ten weeks in

exceptional cases, treatment is to be regarded as unsatisfactory.

The so-called contra-indications to massage treatment more often arise as a result of these fractures than in the case of any other form. Cutaneous blebs are very common, but only limit the treatment to a slight extent. The skin is very liable to suffer so severely that it sloughs, and the fracture becomes compound. This, again, should modify, not prohibit, treatment. Inability to control the fragments during massage merely postpones its commencement.

A few cases will be encountered in which it is found impossible to mould the fragments into shape. If, at the end of three days, marked deformity persists, operation should be advised. "Marked deformity" in these cases may be taken to include deviation of axis, rotation, lateralisation to a greater extent than one quarter the diameter of the Tibia, and shortening. For such cases operation is imperative, but palliative measures must not be given up until an attempt has been made to reduce the deformity under a general anæsthetic combined with the free use of massage. Failing operation a functionally useful limb may yet be assured.

## CHAPTER XXIX

### FRACTURE-DISLOCATIONS OF THE ANKLE

THESE may be divided into four groups according to the direction of the displacement, thus :—

#### 1. Displacement outwards.

This includes :—

- (i) Fracture of the Fibula about three inches above the tip of the external Malleolus.
- (ii) Fracture of the external Malleolus.
- (iii) Separation of the lower epiphysis of the Fibula.
- (iv) Fracture of the internal Malleolus combined with Fracture of the Fibula.
- (v) Fracture through the shaft of the Tibia just above the joint surface, combined with fracture of the Fibula.

(vi) Fracture of the Fibula, and of the Tibia at the insertion of the inferior tibio-fibular ligament. This may or may not be combined with fracture of the internal Malleolus.

2. Displacement inwards.

This includes :—

- (vii) Fracture of the internal Malleolus.
- (viii) The converse of fracture (iv).
- (ix) Severely comminuted fractures of the lower end of the Tibia.

3. Displacement of the foot backwards.

This causes the same type of fracture as (iv), but the fracture usually exhibits combined outward and backward displacement. The foot is rarely everted if the posterior displacement is marked.

4. Displacement forwards does not necessarily entail fracture. Any form of fracture, however, may accompany this displacement.

Fractures (i) to (v) are usually classed together as "Pott's fractures," howbeit the fracture originally described by this surgeon comprised only fractures of the first group. Fracture (vi) is known as Dupuytren's fracture. This may be accompanied by upward dislocation of the foot between the two bones of the leg.

*Classical Treatment*

Cheyne and Burghard, in discussing the treatment of Pott's fracture, press for the use of an anæsthetic for the reduction of the deformity on account of spasm of the calf muscles. If this be severe the splints applied should extend only as far as the knee to allow of treatment with the knee flexed. Otherwise the knee should be immobilised as well. Treatment by massage and movements, they say, finds its most useful application in Pott's fracture. Splints, usually of plaster, are discarded in three weeks, but no weight must be borne on the limb for seven or eight weeks. Dupuytren's splint, Syme's horse-shoe splint, or a splint which is a combination of both, all have their uses.

If the lower end of the Fibula be fractured without dislocation they recommend the use of Croft's splint, the later treatment being "on the lines already laid down for Pott's fracture."

A Dupuytren's fracture is to be treated in the same way, except that inversion must be effectual in preventing any tendency of the Astragalus to rise up against the inferior tibiofibular joint.

Rose and Carless add little of interest save that tenotomy of the tendo Achillis is referred

to in a manner which seems to imply that it might frequently be necessary.

Thomson and Miles recommend daily massage and movements whenever displacement is slight, and also the use of an ambulatory plaster splint. Of the latter treatment they say that "the patient is generally able to resume work within a month of the accident," though the splint is not removed for three weeks. If there is much displacement one of the special splints may be applied for "a few days" before daily massage is commenced.

Holmes recommends treatment similar to that advocated for all fractures of the leg, except that it may be wise to place a longer splint on the outer side of the leg than on the inner side. The splints are to be left in position for six weeks, notwithstanding that Dupuytren advised that the patient "should leave his bed in three or four weeks."

### *Massage Treatment*

If the displacement is great, diagnosis is obvious; if slight, diagnosis may be most difficult. As is the case with all articular fractures, the swelling is rapid and intense and the pain great. Unless the patient is seen during the first few minutes after the accident, diag-

nosis may be made only as the result of careful examination after prolonged massage. If doubt still exists and X-ray examination is unavailable the correct treatment will be that advised for a reduced-fracture dislocation. For the doubt to have arisen the traumatic arthritis must be very severe if there is no fracture, and massage will be the best method of treatment.

There is no need to consider examples of each type of fracture mentioned. A single general law governs the treatment of all alike, and the details applicable in each case do not vary to a greater extent than do those commonly applicable in the case of various fractures of the same type.

The notable common feature of all these fractures is the displacement, which must be corrected, however slight. Few of them, however, present any very gross displacement except Dupuytren's fracture and the fracture of the internal Malleolus combined with fracture three inches or so above the tip of the external Malleolus. Even these two types may not present very marked deformity.

The answer to the question as to what is the most favourable time for effecting reduction is that the earlier the operation is performed the greater is the chance of obtaining a satis-

factory position. Massage cannot be commenced too early and should be performed as suggested in the treatment of fractures of both bones of the leg, the only difference being that greater attention must be paid to the foot and ankle region. In other words, massage must commence at the base of the toes and extend up to the knee. If the fracture is recent, and treatment commences within the first two hours, many deformities will be found to vanish, particularly those which follow fractures of the Fibula or internal Malleolus alone, and the combination of these fractures if there is free mobility.

Massage should be performed for half-an-hour, after which some form of splintage must be applied. Perhaps the best form of splint for all cases is the ordinary box-splint, suitably padded and provided with a vertical foot-piece attached to the posterior splint. It is wise to take this precaution, even in the absence of mobility ; for, if deformity should occur, there is little or no hope of correcting it short of operation, which, in such a case, yields but poor results. One small point is noteworthy in the application of a box-splint. The posterior splint should be sufficiently broad to allow the two lateral splints to rest on its upper surface, not merely to retain their position by means

of the presence of buckles or bandages. If the latter are used, the many-tailed variety will be found most suitable.

If deformity persists after massage, and despite all attempts to mould the fragments into position by means of such movements as may be performed painlessly, or if it recurs readily, some further steps must be taken.

That the use of plaster splints following the forcible wrenching of the parts into position is unsatisfactory is shown both by the frequency of recurrence of the deformity and by the freedom with which tenotomy of the tendo Achillis is advocated. Combined with massage, however, such a method of splintage is nearly always a success. It is always unwise to place a limb in plaster until it is certain that the swelling has reached its maximum, whence it follows that there must be some delay. This also has its advantages, as it allows suitable preparation to be made for a prolonged general anaesthesia.

The first dose of massage and mobilisation having failed to reduce deformity, or if deformity recurs in spite of such treatment (as in point of fact seldom happens), the leg is placed between sand-bags in a box-splint for a period of not less than twelve, nor more than twenty-four, hours. An anaesthetic is then administered and reduction

is performed after massage, slowly, and with such gentleness as is possible. Sudden and violent wrenches are never to be allowed. Massage should be applied for half an hour. The first quarter of an hour is devoted to general massage, the remainder of the time to local treatment of the region of the ankle-joint with the two thumbs, with a little more general massage to conclude. The plaster is then applied.

Due note will have been taken of the degree of mobility present: if it is slight, the plaster may be removed on the fourth day, but in no case should the plaster be left in position for more than a week or eight days.

Every attempt should be made to ascertain the position of the fragments with the X-rays subsequent to reduction, but not until at least twelve hours have elapsed. If deformity has recurred, for no apparent and removable cause, operation should be undertaken; although, in cases for which operation is refused, a useful limb may be obtained by massage treatment even in the presence of deformity.

For cases where the use of plaster is prohibited on account of cutaneous blebs, or when deformity, after reduction under the influence of massage, does not tend to recur, a Neville's splint will be found to be preferable to a box-splint, but it

should be slung and altered in accordance with the advice given in the preceding chapter.

These cases should receive a dose of general massage for twenty minutes a day, the second ten minutes, after the first four days, being devoted to local treatment, especially of the two lateral ligaments. A dose of mobilisation is administered to the toes, and perhaps also to the ankle, but the amplitude must be reduced to a minimum in the ankle during the first four days. No active movement is allowed during this time save occasionally of the toes.

The treatment of these cases and of those which have been kept in plaster for a limited time now proceeds on parallel lines.

In four days' time recurrence of deformity will be very improbable even in those rare cases where mobility has been a marked feature, though here an extra two or three days may well be allowed to elapse before the commencement of active treatment. But it is wise to allow four days even if the tendency to mobility is slight, as it is difficult to remove a plaster splint, even when applied as directed, without causing a certain amount of movement which might prove dangerous if the splint were removed earlier.

Massage should occupy twenty minutes daily,

care being taken to support the two Malleoli, which is best done by one hand while the other is used for massage. During the second ten minutes, which are devoted to local treatment with the two thumbs, support is easy.

The dose of mobilisation is very limited at first as regards amplitude ; each toe is moved in turn, and then follows a prolonged dose of pure flexion and extension of the ankle through a small range. The knee and hip should receive a dose of free movements, and the toes are now left free for occasional exercise. On the third day of treatment, movements of adduction and abduction are begun, and by the end of a week movements should be very nearly full. The patient may then be allowed to swing the leg to and fro, and to practise all movements of the foot, particularly circumduction.

During the third week after fracture movements without weight are commenced, and the use of a splint may be abandoned. At the end of the third week the patient should make his first attempt at walking with the injured limb, the weight being mainly supported on crutches or a chair-back.

At the end of four weeks the patient should be able to walk about the house without assistance, but it is unwise to allow walking

exercise under similar conditions out of doors until a boot can be worn with comfort. The ordinary exercises are prescribed, but the more difficult ones should be reserved until the end of the fifth week. By that time the patient should be walking freely ; but cross-country and similar work should not be indulged in for three weeks more.

The question of foot-gear presents a difficulty. If it is unwise to massage directly over newly-formed callus, it is certainly worse to impose the pressure of a boot ; and, unless this is realised, a patient's progress will often not only be checked but even reversed, obscure pains, loss of movement, and lameness supervening. This is a terrifying event, but is of small significance. A few days' general massage and the use of a shoe is all that is required. Local treatment is meanwhile suspended. It may therefore be found that a patient can be permitted to walk out of doors during the fifth week only with the assistance of a stick.

As return to work is the best cure for all fractures, a steady increase in walking exercise should be encouraged after the fourth week. Bicycling is, of course, invaluable ; and the use of a stationary bicycle during the third week and onwards is most beneficial.

Massage should be continued for at least four weeks.

As already stated, the progress of the case must be regulated according to the nature of the fracture; but, speaking generally, every patient whose case would now be included under the generic term of "Pott's fracture" should be walking freely, with the assistance of a stick, at the end of four weeks. Many patients may be allowed to resume their ordinary avocation in this time: by the end of the fifth week there should never be any further difficulty about walking except in cases of Dupuytren's fracture and those cases in which severe comminution of the lower end of the Tibia has caused a general spreading of the bone, with corresponding deformity of the joint surface. In other words it should be possible to describe the vast majority of cases of fracture-dislocation of the ankle as "completely cured" by the end of six weeks in the absence of such injury as will cause permanent deformity of the joint surfaces. Recovery in these cases will be inevitably postponed; but restoration of function, as far as the deformity will allow, should be complete by the end of eight or ten weeks.

A common sequel to these fracture-disloca-

tions is the development of flat-foot, in spite of perfect reduction, prolonged fixation, and prohibition of function.

Prof. Lucas-Championnière states that he has never yet known this condition to ensue when massage treatment has been employed, but that he doubts whether it is possible altogether to escape the danger. He attributes its absence in his cases to the better quality of the callus formed under the influence of massage, but there may be a further explanation. It must have occurred to anyone who has witnessed the advent of pes planus in cases which have been given a prolonged sojourn in a plaster splint, that the tendency to its formation is present from the first moment the patient puts foot to the ground. The condition may develop gradually, but the first stage, so to speak, is commenced immediately on the removal of the plaster. There are three degrees of pes planus, viz., muscular, ligamentous, and osseous. The primary cause seems to be the inability of the muscles to render efficient support and assistance to the ligaments, particularly the tibialis posticus and flexor longus hallucis tendons to the spring ligament. After a month or six weeks in plaster it is not surprising that the muscles are unable to play

their part in the support of the arch of the foot, and yet patients are encouraged to walk from the outset. Long before the muscles have had the opportunity of recovering their tone the deformity has passed well into the second stage ; nor can anything, save careful and very specialised treatment, then check the progress of the deformity. It follows, therefore, that whenever prolonged immobilisation is practised, due care should be taken to restore the muscular tone and strength by exercises without weight before the patient is allowed to walk. Such procedure might reasonably be expected to avert the catastrophe of flat-foot. Under the treatment already sketched out, the muscles are maintained in a healthy condition by massage during the stage of enforced rest, and their strength and vitality are then improved by exercises to such an extent that any degree of wasting which may have occurred during the few days' rest will have been remedied before the patient is allowed to bear any weight on the foot at all. Exercises are taught which are calculated to strengthen the muscles even beyond the normal, and it would be surprising if flat-foot were to develop, provided the patient is not allowed to walk before the bony union is sufficiently firm. If

the time-limits already mentioned are observed, there need be no fear of making such an error. It seems possible, therefore, that massage treatment may expedite the disappearance of pes planus as a common and disastrous sequel of dislocations of the ankle and all fractures of the leg.

## CHAPTER XXX

### FRACTURES OF THE TARSUS AND METATARSUS

I AM unable to speak from experience of the treatment of these fractures: four only have come under my observation, and these a considerable time after the date of their occurrence. Two were cases of comminuted fracture of the Os Calcis, the other two of fracture of the Astragalus, one being combined with fracture of the Navicular.

All four patients were crippled owing to the presence of osteo-arthritis in the various joints, and by the development of pes planus to the second degree. The two cases of fractured Os Calcis improved considerably under the ordinary treatment for flat-foot by physical exercise and massage, but there was no hope of restoring perfect functional utility. In one of the two cases of fractured Astragalus the bone has since been removed, and it is still in question whether an

arthrodesis or astragalectomy shall be performed to give relief to the other, seeing that the navicular-cuneiform joints are also seriously involved.

### *Classical Treatment*

Cheyne and Burghard say that fracture of the Astragalus alone is of great rarity. Operation is most strongly urged.

For comminuted fracture of the Os Calcis they recommend tenotomy of the tendo Achillis and a plaster splint. Operation is essential if the posterior part of the bone is broken off.

Plaster splintage is advised for fractures of the Metatarsus.

No directions are given as to the duration of immobilisation in any of these cases, or as regards subsequent treatment.

Rose and Carless add little of interest except to advise early massage and movements for fractures of the Astragalus, while Thomson and Miles appear to consider excision of the bone the best line of treatment. These authors recommend massage from the first for fracture of the fifth Metatarsal, and movement in a week ; but all other fractures of Metacarpus and Phalanges should be treated with a rigid moulded splint for an unspecified length of time. In neither text-

book is any other reference made to fractures of the Metatarsus or Phalanges.

Holmes states that rest and soothing lotions will be sufficient treatment for fractures of the Os Calcis ; that fractures of the Astragalus require splintage for six weeks, and that fractures of the Metatarsus and Phalanges “ require only rest.”

### *Massage Treatment*

Prof. Lucas-Championnière does not refer to the treatment of these fractures in his book, and, therefore, the following remarks are founded on the analogy of treatment of other fractures.<sup>1</sup>

All these fractures are articular, or are at any rate accompanied by intense traumatic arthritis. The bones are all very vascular, and may therefore be expected to unite rapidly and firmly. There can, in most cases, be but little displacement. It follows that union, at any rate with the assistance of massage, is assured, and will take place in a satisfactory position—at least as satisfactory as can be obtained by any manipulation, followed by the use of plaster. Operation, short of removal of the bone, cannot offer any great hope of success except in those cases where the

<sup>1</sup> In a *précis* of treatment recently published, the Professor fully endorses the following statements.

portion of the Os Calcis, which carries the insertion of the tendo Achillis, has been torn off.

We may assume, therefore, that the actual bony injury in nearly all cases of fracture of the Tarsus is of secondary importance as compared with that incurred by other structures, particularly the joints. Treatment must be regulated accordingly.

The method employed should consist of a prolonged dose of massage applied as soon after injury as possible, and extending from toes to knee. Particular attention should be devoted to the region of the calf. Pain having been relieved in about twenty minutes, all movements should be performed as freely as may be without risk of its return. Thus the fragments will be moulded into shape if there is any slight displacement, and the *séance* should be concluded with a few gentle passes.

A MacIntyre's splint would form an excellent resting-place for the leg, as it would enable the knee and ankle to be fixed in the position of maximum comfort.

The next day only movements of the smallest possible amplitude should be administered after the massage, but the dose of mobilisation should be increased daily until, at the end of a week, full movement at distal joints and 50% at the joints

nearest the site of injury are obtained. Active movements may then be prescribed.

It must be remembered that the ankle is almost sure to suffer an intense traumatic arthritis, and its ligaments must receive very careful attention.

At the end of a fortnight exercises without weight should be administered, and some patients might be allowed to begin to put the foot to the ground. The majority of fractures of the Os Calcis and Astragalus would call for a somewhat longer rest from their weight-supporting functions, and it would probably be unwise for a patient to begin to use the foot for three weeks, the use of crutches being continued for a month. It will be noticed that this estimate of time contemplates a rather more rapid solidification than was the case with fractures of both bones of the leg. The calculation is based on greater vascularity of the bones. No fear need be entertained of allowing too early freedom, provided that the patient can be relied upon to say if he suffers pain when trying to walk. A rest from the weight-supporting function for three or four days may be expected to render its exercise painless, when no risk will be incurred. A fortnight later a return to perfect functional utility may be hoped for.

Two sequels are common, viz.: osteo-arthritis and flat-foot. Arguing from experience of other articular fractures, the former evil would be reduced to a minimum by massage treatment; while the latter is probably due primarily, not to yielding of the callus, but to the wasting of muscles due to prolonged immobilisation, as was suggested when speaking of fracture-dislocations. It would seem possible, therefore, that this evil might be altogether eradicated.

. . . . .

It is most surprising that the text-books should group together all cases of fractures of the Metatarsus in spite of the differences which it is manifest must be found, considering that the first Metatarsal, *e.g.*, plays a prominent part in supporting the arch of the foot, while the fifth does not do so at all.

These fractures are rarely accompanied by displacement: if it is present it is usually well marked, difficult to reduce, but not liable to recur. The method of treatment varies only in the duration of time which must elapse before a patient is allowed to walk.

The fractures are intensely painful and diagnosis is often obscured by the almost instantaneous swelling. As a rule massage will be found to

render a correct diagnosis possible, but only if the case is seen soon after fracture. Any attempt to elicit crepitus must entail risk of producing unnecessary deformity.

General massage is followed by such manipulation as may be needed to effect reduction. Adhesive plaster strapping will usually act as a sufficient splint. The dose of mobilisation must be regulated by the mobility of the fragments ; as a rule it may be administered with a free hand. The usual duration of a *séance* would be about twenty minutes : ten are devoted to general and five to local massage, the remaining five being occupied with mobilisation. All joints of foot and ankle must receive their dose. It may be necessary to give special attention to the ankle-joint during the last two sections of treatment.

Patients with fracture of the first Metatarsal are allowed to begin exercises without weight in a fortnight, but walking should be prohibited for a month, as the shafts of the bones unite slowly, and this bone has to support great strain.

Cases of fracture of the shaft of the fifth Metatarsal may begin exercises without weight by the third or fourth day, and use of the foot in a fortnight ; while, if the base of the bone is involved (the most common fracture of the Metatarsus), exercises are commenced as soon as pain

## 45° TREATMENT OF FRACTURES

has been relieved, and the patient may begin to hobble about the house in a week. In three weeks at the outside he should be able to resume work, provided it does not entail "heavy walking."

Only a few cases of fracture of the Metatarsus are recorded in my list of cases. They were so common and relatively uninteresting that I kept no record of most of those I treated. Those which are quoted contrast admirably the extraordinary difference in the duration of treatment according as splintage or massage and mobilisation is the method adopted.

## CHAPTER XXXI

### FRACTURES OF THE FEMUR AND PATELLA

IN the absence of personal experience of the treatment of these fractures by mobilisation and massage, I have, for the sake of completeness, reproduced the main outlines of treatment as described by Professor Lucas-Championnière.

#### FRACTURES OF THE SHAFT OF THE FEMUR

For fractures of the diaphysis of the Femur he recommends extension, preferably by Hennequin's apparatus, with massage treatment daily or every other day. If an immovable apparatus is employed, great relief may be given by a preliminary *séance*. The massage consists of the usual gentle stroking in an upward direction, the amplitude being as great as possible.

All movements possible are administered to hip, knee and ankle without, however, inter-

ferring with the extension. Such movements are necessarily small, but being oft repeated are an ample security against the formation of adhesions and permanent stiffness.

The Professor does not regard this treatment as calculated to shorten the time before a patient should be allowed to stand on the injured limb ; but the progress of the treatment is such that, as soon as the bony union is firm enough for the support of the weight of the body, the functional utility will be completely restored. He also claims that stiffness, pain, and swelling will not occur when the patient is allowed to use the limb.

#### FRACTURES OF THE NECK OF THE FEMUR.

The Professor begins his consideration of these fractures by saying that the distinction between intra- and extra-capsular fractures is of little pathological interest, and of still less interest from the point of view of treatment, since both forms must be regarded as “articular fractures.” He says that union, as a rule, takes place readily, subsequent inability to walk being due not to the lack of firm skeletal support or deformity, but to the fact of the joint having been rendered useless by fixation and the muscles being devoid of strength.

An outward deviation of the foot may have an ugly appearance, but it is not a cause of disability provided that treatment by mobilisation has been carried out: the lameness and the pain which may persist for years are the result of fixation during treatment, while the reduction of the deformity will be, at best, only partial.

In the aged any attempt to obtain union by fixation commonly means "death, slowly or quickly." Movement, on the other hand, affords a greater hope of attaining union as well as restoration of function. Impaction must be respected as being the condition most favourable to the rapid progress of mobilisation treatment.

The value of massage is doubtful where the patient is very aged: in such cases the region of Scarpa's triangle should be avoided if massage is applied. It is always of secondary importance as compared with mobilisation, but it affords great relief.

Diagnosis rests on position, loss of function, seat of pain, shortening, and, if present, broadening of the great Trochanter. There should be no attempt to elicit crepitation for fear of disimpacting the fragments.

Movement must be administered daily, and must be gentle and progressive. It should, of course, be limited by the onset of pain. After a

few days very slight active movements may be allowed.

As soon as a patient will consent, though it be on the day after the fracture, he should be moved from bed into a chair. At all costs the move should be made within twelve days. As soon as possible thereafter the use of crutches begins, and the patient is encouraged to put the foot to the ground. The result always compares very favourably with that obtained by other methods of treatment.

#### FRACTURE OF THE LOWER EXTREMITY OF THE FEMUR AND FRACTURE OF THE CONDYLES

The proximity of the joint renders massage treatment highly desirable, but the difficulties to be encountered are great. If a satisfactory position is unobtainable in the course of a few days, operation should be undertaken for all fractures above the condyles where the lower fragment has been tilted backwards.

Condylar fractures, on the other hand, yield excellent results when treated by massage and movements alone. A trial walk may be attempted at the end of three weeks, and an extra week's treatment will enable the patient to get about with some freedom.

If fracture is diagnosed and the upper end of the lower fragment is not rotated backwards into the popliteal space, massage treatment should begin at once. The actual nature of the fracture is of minor importance.

General massage of the whole limb is employed, but the region of the joint must have special attention, which is best afforded by the use of the two thumbs ; but, since the actual site of fracture is to be avoided when using this method, the lower part of the joint is that which will receive the closest care.

Mobilisation should be restricted to minute movements : amplitude will be regained rapidly as soon as the patient begins to walk, which will be at the end of a month. The ultimate result will be that the function of the limb is in no way compromised, whereas the prognosis after treatment by splintage is most unfavourable.

#### FRACTURE OF THE PATELLA

Treatment of this fracture by massage offers no hope of obtaining bony union if there is wide separation of the fragments. With this limitation the treatment cannot be considered ideal, and operation should be performed whenever possible. If, however, such interference is im-

possible, massage treatment can restore to a limb a large degree of its functional utility, which is very liable to be lost irretrievably if the limb is immobilised.

The failure to obtain bony union is due to the presence of fibrous tissue between the fragments, these being tilted. The loss of function is to be largely accounted for by the atrophy of the quadriceps extensor which has been deprived of its insertion, the result being atrophy of this muscle directly, and, reflexly, of its antagonists ; and only to a small extent by the gap existing between the fragments. In certain rare cases, particularly if fracture has been caused by direct violence, bony union may take place as the result of massage treatment ; but these cases are too rare to justify such treatment if operation is possible.

If, however, the age or health of the patient prohibits operation, and it must be remembered that bone operations in chronic alcoholics are often unsatisfactory, or if there is no displacement, as in the "star-shaped" fractures, massage treatment is strongly indicated.

Diagnosis is usually obvious, but gentle palpation may be necessary. There is no occasion to bend the knee through more than a few degrees to establish mobility, if there be any, of the

fragments. A few cases may require massage before diagnosis can be made without causing intense pain. If there is no displacement, X-ray examination may be necessary.

No apparatus should be used, but a sand-bag may be placed on either side of the limb. Massage, of course, is chiefly applied to the anterior aspect ; but the posterior should receive such attention as may be possible by resting the heel on a low support, though the process of raising the foot from the bed on to the support must be carried out with the care necessary to avoid flexion. It is better not to move the limb until the massage has commenced. The whole limb should be massaged, but the lateral aspects of the thigh, particularly the inner aspect, need special attention. The two thumbs, used alternately or together, are then employed in treating the various accessible ligaments of the joint: it is not enough to confine treatment to the region of the Patella, the lateral ligaments must also have their share.

When massage is complete movements of very small amplitude are imparted to the limb. It is not improper to let patients begin to walk in ten or twelve days ; but little benefit only will result ; and there is considerable risk of jeopardising recovery. In six weeks' time a patient should

be able to get about with perfect freedom, but as the quadriceps will still lack strength he will have a sense of insecurity. There will not, however, be any pain and stiffness. The separation of the fragments will be no greater than if any other treatment, short of suture, had been employed. No prognosis can be formed as to the liability of the fibrous union to stretch: it is not, at any rate, greater in consequence of massage treatment.

THE END



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